

September 2008 Newsletter



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UPMC Conference Discusses Newest Scientific Knowledge Forcing Doctors To Re-Think How To Safely Manage Concussions In Athletes Of All Levels

Treatment of concussions remains arguably the most complex and controversial issue in sports medicine for athletes of all ages, yet concussions occur in millions of athletes each year.

The good news is that new scientific research continues to provide clearer knowledge for team doctors and athletic trainers, helping them to recognize and quantify the symptoms and effects of concussions.

On Thursday, July 24 and Friday, July 25, the country's leading experts convened at the Sheraton Station Square in Pittsburgh to share the newest information as UPMC Sports Medicine hosts "New Developments in Sports-Related Concussion." This scientific conference highlighted the latest important research findings. A panel of experts lead discussions and facilitated hands-on injury treatment workshops to an audience of more than 250 doctors, neuropsychologists and athletic trainers

from the U.S. and abroad.

Top pro sports agent Leigh Steinberg was a keynote speaker. Mr. Steinberg is regarded as the nation's leading sports attorney and the inspiration for the popular film, "Jerry Maguire".

"Leigh has been very passionate in his work with team doctors and athletic trainers to ensure that athletes of all levels, not just professionals, get the best possible care. He has been an active proponent of advancing scientific research that benefits everyone," said Mark Lovell, Ph.D., director of the UPMC Sports Medicine Concussion Program and conference co-director. "We are both pleased and honored that he is participating in this important conference."

According to Mr. Steinberg, "The specter of concussions in collision sports continues to be a largely undiagnosed health epidemic for which baseline neurocognitive testing is the

best antidote. Dr. Lovell and UPMC are on the cutting edge of this with their critical research, providing new hope to millions of current and formerly afflicted athletes."

"A long-standing national voice raising public awareness of this pervasive public health issue, Leigh has had a genuine impact on concussion management across the nation," said Joseph Maroon, M.D., professor of neurological surgery at the University of Pittsburgh School of Medicine and long-time team neurosurgeon for the Pittsburgh Steelers.

Other conference highlights included:

- Newest advances in brain imaging and their implications for injury management and recovery
- Recently published groundbreaking data on age and gender factors that prove concussions should not be treated as a "one size fits all" injury
- New, still-developing protocols for injury

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PRESENTATION**

Presented by:
Summer D. Ott, Psy.D.,
Drew Wroblewski,
Michael W. Collins, Ph.D.

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treatment that is changing the general "just rest" philosophy of treatment and includes medication and physical rehabilitation

- New experiences with the management of high school athletes
- Newest protocols for baseline and post-injury neurocognitive testing

"Managing sports-related concussions has changed dramatically over the past five years and is likely to continue to change as new research is completed and as we explore new medical treatments," said Dr. Lovell. "One of the most important recent advancements has been the use of active rehabilitation programs like the one developed at UPMC to safely get young athletes back in the game."

There are still misperceptions out there about this injury, but we have proven, effective management protocols available for athletes of all levels," added Michael (Micky) Collins, Ph.D., assistant director of the UPMC Sports Medicine Concussion Program and conference co-director. "Injury management is the key."

"For every concussion we see occurring at the professional sports level, there are tens of thousands of injuries at the high school level and below. This comprehensive meeting of experts will review the tremendous strides we are making for younger athletes as well as the pros," said Dr. Collins.

About the UPMC Sports Medicine Concussion Program

The UPMC Sports Medicine Concussion Program, established in 2000, is an ongoing clinical service and research program that focuses on the diagnosis, evaluation and management of sports-related concussion in athletes of all levels.

The program's internationally known team of clinicians and researchers are world leaders in studying the neurocognitive effects of sports-related concussion, publishing groundbreaking scientific research involving high school and college athletes, and pioneering the development of better methods of post-injury evaluation to determine when it is safe for an athlete to return to sports.

For more information, go to: <http://www.upmc.com/Communications/MediaRelations/MediaKits/Kits/ConcussionMain.htm>

Sports Agent Leigh Steinberg Concerned about Concussions

After the 1994 NFC Championship Game, sports agent Leigh Steinberg visited a dark hospital room in Dallas. The lone occupant was one of his clients, Cowboys quarterback Troy Aikman, who was Super Bowl-bound.

The trouble was, Aikman didn't know it.

The Hall of Fame quarterback had suffered a concussion during the game. Upon seeing his agent, Aikman asked Steinberg where he was, did he play that day, did the team win and what did that mean. The answer to the final question made Aikman smile.

Five minutes later, Aikman asked Steinberg the same questions, with the same reactions. After another five minutes, the same questions came again.

That was the night the agent, who has managed Ben Roethlisberger, Matt Leinart and other high-profile NFL players, learned the seriousness of concussions.

"I was terrified at the understanding of how tender and narrow that bond was between cognition and consciousness and dementia and confusion," Steinberg said.

He has since been deeply involved in spreading awareness of and promoting protection from concussions in athletes at all levels in all sports.

His crusade took him to the Sheraton at Station Square on July 24th

to be keynote speaker at the New Developments in Sports-Related Concussions conference hosted by UPMC Sports Medicine.

The conference brought in the nation's top minds to discuss the latest research findings on concussions and facilitated hands-on injury treatment workshops.

"There's been huge advancement in this area," said Dr. Micky Collins, the assistant director for the UPMC Sports Medicine Program. "We've learned more in the past five years than the previous 50 combined."

The research, coupled with new testing procedures, has helped doctors and athletic trainers become more adept at managing the injury. The Impact Test, used by 1 NFL, NHL and MLB squads and thousands of high schools across the country, allows athletic trainers to gauge the severity of the injury and determine if a player is recovered from a concussion.

"Now that we've been able to measure it effectively, we're starting to learn about risk factors, recovery and who may be more at risk than others," Collins said. Even with more knowledge of the injury, which can have an effect on a concussed person's memory, reflexes and hand-eye coordination over a long period of time, many athletes try to downplay the effects to get back on the field

quicker.

"My clients, from the day they played Pop Warner football, are taught to believe ignoring pain, playing with pain and being part of the playing unit was the most important value," Steinberg said.

The agent especially sees a problem with that line of thinking, when younger generations begin to follow the model of their heroes in the professional ranks. Juveniles' brains aren't as fully developed as adults', making them more susceptible to concussions.

But the NFL recently has begun acknowledging the danger. In June 2007, the league had its first physicians' conference to address the issue and had another one this year. League commissioner Roger Goodell also is encouraging players to come forward if they know of a teammate who has suffered a concussion but hasn't made it known.

"The reason why the NFL is so important is it's the symbolic trigger for the behavior of college and high school players and athletes in every other collision sport," Steinberg said. "As it addresses this issue, so will everyone else."

Source:
www.pittsburghlive.com



[Wal-Mart donates to
concussion prevention program
sponsored by ISU's Faure](#)

<http://123idaho.blogspot.com/2008/08/wal-mart-donates-to-concussion.html>

Wal-Mart and Sam's Club announced it will donate \$30,000 to the youth head concussion education and prevention program, sponsored by Dr. Caroline Faure, Ed.D., assistant professor in the Department of Sports Science and Physical Education at Idaho State University. The donation from Wal-Mart will help create a grass-roots education program for coaches in youth sports, aimed at assisting them in better identifying the symptoms of concussions and how to prevent and manage concussions when they occur.

Every year one in six high school football players will sustain a concussion. When treated incorrectly, a concussion can have devastating effects on young athletes, sometimes even resulting in death. Dr. Faure recently completed a study that determined many Idaho football coaches are unfamiliar with the signs and symptoms of concussion and are inexperienced in managing instances of mild concussion.

"Coaches express interest in wanting to learn more," said Dr. Faure. "This generous donation from Wal-Mart will help us provide these coaches with the expertise to manage concussion and decide when it is safe to let athletes return to physical activity."

When concussions are not managed correctly, the side effects can be long term and can even result in death. Symptoms include headaches, depression, mood swings and learning disabilities. Sudden Impact Syndrome (SIS), the most dangerous effect, occurs when an athlete who has sustained one head injury returns to play too early. If the athlete then sustains a second concussion before the symptoms associated with the first blow have fully healed, the result could be death.

"In my study, I found that many coaches, especially those at schools without designated athletic trainers, were not following research-based approaches to concussion management and their lack of understanding clouded their judgment when making decisions about returning players to the field," explained Dr. Faure.

The educational program Dr. Faure is developing will help youth sport coaches identify a concussion along with objective ways to manage concussion and to determine when it is safe to return athletes to play.

"Wal-Mart believes in supporting localized, grass-roots programs with the ultimate goal of supporting the communities where we operate and live. Dr. Faure's research serves a critical need in ensuring the health and safety of our youth. We applaud her efforts and hope this donation helps in creating a useful, crucial program for coaches, mentors and players alike." said Gary Black, Pocatello Wal-Mart Store Manager.

The program will be teaching youth sport program administrators about the value of ImPACT.

A Clinicians Guide to Setting Up the On- line Testing System

As a sole proprietor in private practice I did not have a company website in place or an IT department to enlist when ImPACT began to be offered an on-line platform. Taking into consideration the nature of my practice along with the current and forecasted needs of any consulting arrangements that I would develop indicated that I would need a website that would provide information to athletes, parents and the sport community; allow for multiple or flexible approaches to conducting baseline evaluations based on the nature of my business associations; and be affordable. It is important to highlight that this is but a single approach that met the needs of my particular practice.

Website Development: I searched Yahoo! for domain names and went with Yahoo! Small Business, which felt legitimate, was affordable and provided other web tools. A domain name was established and a temporary web page was developed in an effort to promote crawler recognition in web searches. Given my limited web design skills and the need to incorporate payment gathering I searched for local web designers to help with a more complete website. I was able to arrange meetings with several web designers through word of mouth referrals or by the local chambers of commerce, pitched my vision of the website and gathered their bids. HINT: web designers will gladly do as much as you ask them to do but will charge you their hourly programming fees. I provided all text, page organizations and reference links, which allowed the designer to focus on packaging, page appearance, etc and saved considerable money.

Collecting Payment: My overall volumes were expected to be relatively small and establishing an independent Visa or Mastercard account was suggested as unnecessary. Establishing a PayPal account was recommended as the most efficient means of collecting payment, services charges were minor and most Internet users have a basic comfort and familiarity with PayPal. There are other programs out there, so be sure to do your homework to see which is best for you. Go to the PayPal homepage and look for "How to get started". You will need to sign up for a PayPal Business Account and then Verify your information. You will need to provide some personal financial information, such as a checking account, after which PayPal will send you small amounts of money - you must report back the amounts to verify legitimate ownership of the checking account. The process is not terribly inconvenient but you do need to allow several business days to complete all the tasks.

Integration: Once the PayPal process was complete I relayed the necessary information to the web designer to incorporate the necessary links and sequences that would take the adult athlete or parent from my website to PayPal and then on to the online testing page to complete baseline testing. It's been solid and successful and I've not yet received any negative feedback from users.

Dr. Czarnota is a neuropsychologist in the Detroit area who earned his Ph.D. from Wayne State University and completed a two-year rehabilitation neuropsychology fellowship at the University of Michigan Medical Center. He is now in private practice and has made sport concussion manage-



ment a growing part of his practice since 1999. He has implemented concussion management programs with high schools, universities and professional leagues that include national and international organizations. For more information, visit www.sportconcussions.com or call 248 253-8208.

FAQ:

When should I begin to question if a student did not understand some of the test, or if they tried to sandbag it? What is an unacceptable impulse score?

Typically, at baseline, any impulse control score above 30 indicates that something went wrong with the test. Typically, this would indicate that they did not read the directions correctly for the x's and o's interference test (left/right click), the three letters test (they may have counted forward instead of backwards) or the color match test. Below is a link to a form highlighting the most common errors on ImPACT, how to create the composite scores, and how to recalculate their scores if these errors do occur. Again, a score of greater than 30 indicates something went wrong with baseline. Post concussion, however, this score may be highlighted simply due to the concussion and not that it is invalid. Also, the check the validity of a baseline test, be sure their normative data is commensurate or equal to where you might expect that student/athlete to be. For example, an Average to Above Average student should be at least 50th percentile or higher across the composite scores, etc.

[ImPACT Test Invalidity:](http://www.impacttest.com/pdf/ImPACTTestInvalidity.doc)
<http://www.impacttest.com/pdf/ImPACTTestInvalidity.doc>

[Composite Score Formulas:](http://www.impacttest.com/pdf/CompositeScoreFormulas.doc)
<http://www.impacttest.com/pdf/CompositeScoreFormulas.doc>



Dartmouth Medical School and Maine Army National Guard Announce Brain Injury Screening Program

CONTACT: (NEW HAMPSHIRE): ELIZABETH PEARSON, DARTMOUTH MEDICAL SCHOOL, (603) 653-1442

LEBANON, NH -- Dartmouth Medical School and the Maine Army National Guard have announced a strategic collaboration to launch a two-tiered Mild Traumatic Brain Injury (mTBI) Program involving both state-of-the-art screening and a system of integrated care to meet the needs of returning soldiers through collaboration between private and public community-based providers.

The collaboration between Dartmouth Medical School, the Maine Army National Guard, ImPACT Applications, Inc. and the Maine Brain Injury Partnership Project will work toward a system of care for Maine service members that is integrated among community based health and mental health providers, community and military resources. The mTBI program is funded by the Maine Health Access Foundation's integrated care initiative.

A series of educational workshops is planned that will increase healthcare providers' ability to identify and appropriately care for mTBI injuries, respond to the individual's identified needs and priorities, and address the interrelated domains of health, mental health and psychosocial support. The first training workshop will take place on June 11 at University of Maine, Orono and June 12 at Maine Medical Center.

Elizabeth Pearson, MSW, of Dartmouth Medical School, is the Director of the collaborative project, and has worked in Maine for several years building capacity to provide comprehensive care coordination within primary care practices. "There is a lot of excellent work going on in Maine

right now that enhances collaboration across existing systems of care," Pearson said. "This project will help maximize available resources, including an existing and validated screening program, so that all of our service members have the highest rate of recovery from mild traumatic brain injury."

One of the key features of the program centers on the pre- and post-deployment screening for mTBI, which is accomplished through the use of ImPACT™, a computer program that can be administered by non-clinical personnel with minimal training. ImPACT™ is a validated instrument that is widely used among professional sports teams to manage sports-related concussions. In November 2007, all Maine National Guard troops began the process of receiving ImPACT™ screening before and after deployment to war zones.

"ImPACT was designed to provide a comprehensive brain injury management system that provides valuable information to individuals and doctors," said ImPACT™ developer Mark Lovell, Ph.D., Director of the University of Pittsburgh Medical Center Sports Medicine Concussion Program, who also serves as a consultant for the neuropsychological testing programs of the NFL and NHL.

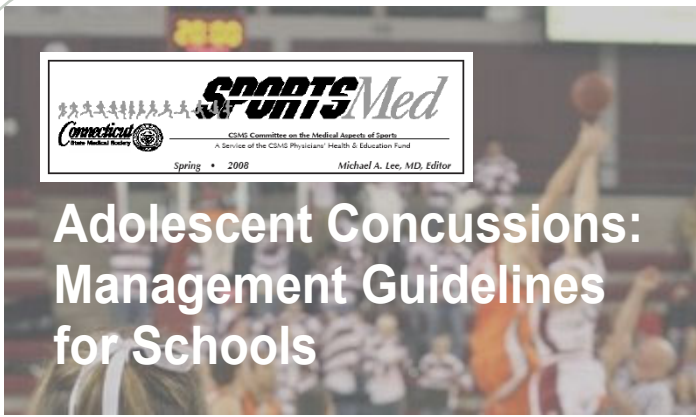
Interest in mTBI has been heightened with the recent conflict in Iraq and Afghanistan. Roadside improvised explosive devices (IED) are the signature weapon in the current conflict and, as a result, many service members are experiencing concussive brain injuries. Accurate identification of

these injuries is important for appropriate treatment.

The signs of mTBI may be confused with the psychological response of post-traumatic stress disorder, or PTSD. While an individual may experience both conditions and there is some overlap of symptoms such as sleep issues, fatigue, and irritability. Other symptoms such as dizziness, visual blurring, balance impairment, sensitivity to light and noise are associated with mTBI. "We need to help identify the cause of symptoms and this screening program will enable the National Guard medical team to more effectively screen service members for appropriate diagnostic procedures," says Pearson.

"The percentage of American troops who are surviving battle wounds has risen dramatically, which is great news, but which does come with an associated set of problems," says Lt. Colonel Patrick Tangney, M.D., the Maine Army National Guard State Surgeon. "Substantial advances in battlefield armor and medical treatment means that more people are surviving injuries that would have been far more serious in previous conflicts. The number of U.S. soldiers sustaining some sort of brain injury in combat is high, but not always easily detected. "Maine is the first in the nation to use this model of screening to ensure that our returning soldiers are getting the care they need, and the right care, every time" says Tangney.

For more information about the Maine mTBI program, or for registration information for the June workshops, contact Elizabeth Pearson at Dartmouth Medical School, (603) 653-1442.



Adolescent Concussions: Management Guidelines for Schools

MICHAEL A. LEE, MD AND VITO A. PERRIELLO, JR., MD

Our knowledge of concussions has increased and our treatment has changed substantially in recent years based on new research. Some of the major changes include the awareness that “minor head injuries,” frequently called “bell-ringers or dings,” are in fact concussions; many relatively minor head injuries take longer to heal than previously believed; concussions can occur without loss of consciousness, vomiting or other symptoms. Often times, headache, dizziness, “fogginess,” poor attention span and unusual behavior are the signs of concussions. Another major change is the knowledge that thinking, “exercising the brain” and nearly all cognitive tasks have the same effect on prolonging concussion symptoms and slowing recovery as does physical exertion. Consequently, the management of even these minor head injuries has changed dramatically. Restricting mental exertion and physical exertion until asymptomatic and then gradually increasing each is the cornerstone of this treatment strategy.

Over the past several years increasingly larger numbers of adolescents are sustaining concussions. This may partially be due to our greater awareness. While caring for them, it has become evident that concussed individuals need modification of their school day in order to recover most expeditiously.

At the high school level, returning the student athlete to school is generally the highest priority and the one that carries the lowest risk once symptoms have disappeared. The school nurse, guidance counselor, certified athletic trainer, athletic staff, psychologist and social worker should be made aware of the student athlete’s injury and work as a team to coordinate these accommodations. This will ensure a smooth transition to this new activity plan during this difficult period. Attending school presents a major problem for student athletes suffering from a concussion whether it is at the high school or college level. Teachers and professors often believe that the student-athletes are

malingering and they can be less than sympathetic when student athletes are excused from tests, or need extra time for tests and turning in papers. Team coaches often fail to understand the severity of the injury and may want their athlete, especially the star athlete on the team, to return to play before they are fully recovered. Coaches may be unsympathetic to the needs of the injured student-athlete and may be unaware of *Second Impact Syndrome* or more common risks of re-injury and prolonged recovery. The absence of visible signs of injury, such as a cast, brace or bandage, contributes to this misunderstanding by coaches and others. Adolescents with concussions may want to attend school out of fear they will miss necessary work and get too far behind. They often want to socialize with their friends and continue to participate in their usual activities. If they have a part-time job they may also want to continue their usual work schedule. Since student-athletes with concussions seem to recover more rapidly with rest, we recommend that activities should be restricted for several days following the injury until they are headache free. Exercise, whether it is physical or mental, will usually increase their symptoms: headache, dizziness, nausea and lightheadedness. Most student-athletes will have difficulty with concentration, memory (both working and short term), and their processing speed—which negatively affects their school learning and performance. In turn, struggling to learn and perform “overuses” the brain at a time when it is working hard to recover, and can negatively affect recovery. As a result, the guidelines for return to school are listed below:

No School Initially

A concussed individual should not return to school until his/her headaches and other symptoms have cleared. At home, the student-athlete should rest. To minimize increased oxygen demands on the injured vulnerable brain cells, athletes should not participate in the following activities: reading, computer use, video-

games, text messaging, physical exercise, hot tubs and socializing with friends. Attending movies may cause a marked increase in symptoms if the student-athlete experiences difficulty with light or noise. When student-athletes are headache free, they can begin trying brief periods of reading or studying. If headaches or other symptoms return they should discontinue the activity and resume rest. They may return to school for gradually increasing periods of time when they can tolerate a couple of hours of thinking. Some student-athletes may require starting school later in the day in order to sleep longer. They should be driven to school to avoid noise on the bus or the exercise of walking to school. Student-athletes may attend classes unless they develop symptoms (usually a headache). If they become symptomatic they should go to the nurse’s office, lie down, and skip the next period. **(Rest periods often may be necessary when student-athletes first return to school.)** If symptoms occur again in the next period, after resting, they should return home. Math and chemistry classes may need to be avoided initially since they seem to cause more symptoms than other classes. If a student-athlete can only attend school part-time, noncore classes should be avoided in favor of core subjects (English, History, Science and Language).

School Nurse’s Role:

After sustaining the concussion, and before the student-athlete returns to school, the nurse should receive a letter from the physician. The letter will describe the student-athlete’s injury and the specific and necessary modifications to the school day. This letter will serve to notify all parties involved that the day must be modified and that the student-athlete is not malingering. The nurse will serve as a liaison between the teachers, athletic trainers and coaches to facilitate the changes. If no school nurse or athletic trainer is available, the student athlete’s guidance counselor should be the contact person for the physician.

Test Taking

Most student-athletes are so symptomatic in the early post injury phase they are unable to take tests. If they do attempt to take tests before they are recovered sufficiently, they may become dizzy and nauseous or manifest other post concussion signs and symptoms that negatively affect their performance. If the student-athlete has taken any tests during the time he/she is recovering and received poor test scores, it is appropriate to ask that these grades be voided or discounted. SAT, ACT, AP, and GRE tests may need to be postponed and some student-athletes may need to obtain permission beforehand for extra time while taking these examinations. Final ex-

aminations may need to be delayed until school breaks, the next semester or during the summer. When student-athletes do return to school they may need to have untimed tests due to their decreased processing speed. Taking tests should be spaced out and limited to no more than one per day. Tests may need to be taken in a quiet place, free of distraction, since some post concussion student-athletes have ADHD-like characteristics such as distractibility and difficulty with concentration.

Unfortunately, there may be some student-athletes with prolonged symptoms who will need to miss an extended period of school during the recovery. Teachers should take this into account when assigning grades. Possible solutions for this problem include: exempting student-athletes from tests, especially if they have done well previously, or assigning grades for that period of time, based on their previous work.

Papers, Projects and Homework

Term papers and projects may need to be delayed and spaced out. Extensions for work should be given. Extra time for homework may be necessary. Preprinted class notes or copies of class notes are often helpful. Recordings may be helpful for student-athletes with reading difficulty due to their symptoms. Having someone read material to student-athletes may be of benefit. Some student-athletes may need tutors to help them with schoolwork, including test preparation and organization.

PHYSICAL ACCOMMODATIONS

Elevators:

Initially, student-athletes should not walk up stairs if there are elevators in the school. An elevator pass should be given unless the student-athlete becomes lightheaded or dizzy when riding the elevator.

Noise: If noise is not well tolerated by these student athletes they should be excused from music class. It is recommended they sit in a quiet spot during lunch (not in the noisy cafeteria) and should avoid assemblies, school dances or sports events. It may also be helpful for these student-athletes to leave class a few minutes early to go to the next class in order to avoid the noise in the hall. Construction noise at school may also increase symptoms.

Light: Student-athletes, especially those with injuries to the back of the head, can have difficulty with light. Bright fluorescent lights or watching movies in a dark room may cause or increase symptoms such as headaches. They may need to wear sunglasses in and out of school. If light is a problem, student-athletes may have

Adolescent Concussions: Management Guidelines for Schools, con't

difficulty driving at night due to the glare of headlights. Activities with strobe lights should be avoided.

Preferential Seating: Student-athletes who develop ADHD-type symptoms following their concussions are advised to sit in the front of classrooms and to sit away from windows and doors to avoid distractions.

Gym Class and School

Sports Team: Both should be avoided initially. Attending a team's practice or game can increase symptoms due to the noise, light and "rough-housing" with their friends. Student athletes might sustain another head injury if they are inadvertently struck with a ball. As they recover, they may attend—but not participate in—practice and games as long as the symptoms do not increase.

Return-to-play: An athlete is allowed to start an exercise program when they are not taking pain medication and are both symptom free and have normal neurocognitive test results (if available). They may walk the first day, jog the following day and run the third day (see guidelines from the last *International Conference on Concussions in Prague*). When the steps are completed without symptoms, they may practice sport specific drills with their team and then finally, full participation, including contact, is allowed. This is usually a five-day process. Some athletes who have missed many weeks of play may need to recondition before returning to sports.

Student-Athletes with Prolonged Absences:

Approximately 10% of student-athletes with concussions have symptoms lasting over a month and they are considered to have a *Complex Concussion* (the newest terminology) or what in the past was described as Postconcussion Syndrome. Some student-athletes may need to have a 504 plan adopted and some student-athletes who cannot tolerate the active school environment may require home tutoring. The guidance counselor may be asked to expedite some of

these accommodations.

Psychiatric Issues: Some student-athletes may develop depression either as a result of the injury or because they are unable to attend school and participate in sports. They may become irritable and more emotional than usual. Support for this problem may be addressed by the psychologist, guidance counselor, or social worker on the school staff.

SUMMARY

While many clinicians do not allow concussed individuals to return to physical exertion after sustaining a concussion, they are allowed to return to school with the admonition "if your symptoms increase you need to discontinue the activity." This is difficult for most adolescents to follow once they are in school attending classes and socializing with their friends. To prevent worsening of symptoms and possible prolonged recovery in concussed individuals, both mental and physical exertion is not recommended during the early stages of recovery. We recommend a return to school once the symptoms have cleared. A summary of the recommendations in this article are outlined below.

Michael A. Lee, MD is a pediatrician with Pediatric Healthcare Associates in Southport, Connecticut specializing in adolescent and sports medicine. He is a charter member of AMSSM and Medical Director of the Student Health Center at Fairfield University.

Vito A. Perriello, Jr., MD is a pediatrician with Pediatric Associates of Charlottesville, LLC in Charlottesville, Virginia. He is the Chairman of the Sports Medicine Advisory Committee of the National Federation of High Schools, Physician Director of Board of certification of NATA, and on the Executive Board of USA Lacrosse.

References:

Aubry M, Cantu R, Dvorak J, et al: Summary and Agreement Statement of the 1st International Symposium on Concussion in sport, Vienna 2001 *Clin J Sports Med* 2002; 12:6–11. Summary and agreement statement of the 2nd International Conference on Concussion in Sport, Prague 2004. *Clin J Sport Med* 2005; 15(2):48–55. HEADS UP CONCUSSION IN YOUTH SPORTS U.S Department of Health/Human Services Centers for Disease Control and Prevention; www.cdc.gov/injury www.cdc.gov/ConcussioninYouthSports

The Student-Athlete Return to Play Protocol

Initial Treatment:

- No physical activity should occur until the athlete's symptoms are gone
- Avoid mental (cognitive) exertion; school attendance, test taking, reading, studying, computers, video-games, and text messaging

(Note: The student-athlete may watch television, listen to books on tape or soft music for brief intervals as long as the symptoms do not increase.)

When no symptoms are present:

Step 1. Advance by beginning short periods of reading, focusing, and abbreviated school attendance

Step 2. Advance when a full day of school is tolerated, begin low impact activity such as walking, stationary bike, etc. (Gradually increase the intensity and duration as tolerated)

Step 3. Advance to aerobic activity fundamental to the specific sport such as skating, running, etc.

Step 4. Advance to noncontact activity drills to the specific sport such as dribbling, batting, shooting

Step 5. Advance to full contact in a practice setting

(Note: The student athlete must remain asymptomatic to advance through the various levels or return-to-play as described above. If symptoms return, while exercising, the athlete should return to the previous activity after waiting a day.)

If all the above is accomplished without any return of signs and symptoms, they may return to play following final clearance. Some athletes, especially if they had multiple previous concussions, should consider having a baseline computerized neuropsychological test performed because of the increased risk of concussion.

ImPACT's Web Based Program:

WE ARE PROUD TO ANNOUNCE THAT WE NOW HAVE OVER 200,000 ONLINE TESTS COMPLETED

What is the difference between ImPACT Desktop and ImPACT Online?

Online ImPACT is a web-based application that allows you to do ImPACT testing from almost any computer with an Internet connection. All the ImPACT data is stored and backed up on a secure server in Pittsburgh. The computer must have Flash player 8.0 or later, and pop up blockers turned off. Below is a link to Online ImPACT's technical requirements.

http://www.impactestonline.com/results/ImPACT_Applications_Tech_Facts.pdf

Desktop ImPACT is a traditional computer program that needs installed to your local PC. Almost any computer produced in the last 10 years will have enough memory and processing speed to run ImPACT. Desktop ImPACT works with Windows Vista. The data is stored on your personal computer or the school / organizations network server.

I currently use Desktop ImPACT, how do I switch and what is the cost?

Desktop ImPACT and ImPACT Online have the same pricing structure (see pricing pages below). You can switch in the middle of a yearly contract with no additional costs. We will even allow you to run both systems during the changeover period.

Current Pricing

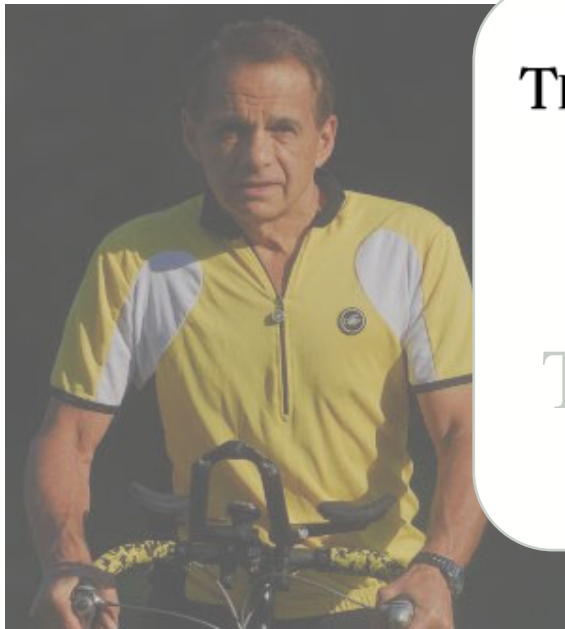
<http://www.impacttestoffice.com>

What happens to my Desktop ImPACT data when I switch to Online ImPACT?

Unfortunately, the data is not transferable between systems. Schools employ one of two methods when they make the conversion. There are pros and cons to each option, you must work out what is best for you. Switch to online and have all the kids retest in the new system. Maintain both systems (no additional cost) until all the athletes have cycled out of the desktop system.

What version of ImPACT are most organizations choosing?

About 85% of new purchases are selecting Online ImPACT. If you can make this system work at your school, I would highly recommend it. Online ImPACT requires less time from your IT department and safer storage of your data.



**PITTSBURGH
TRIBUNE-REVIEW**

UPMC Surgeon Trains for Ironman

There are overachievers, and then there is Dr. Joe Maroon. Three or four days a week, he swims an hour at Sewickley YMCA, beginning at 5:15 a.m., before heading to his job as vice chairman of the department of neurological surgery at University of Pittsburgh Medical Center. He'll operate, see patients or both, and then he'll bike or jog for about an hour. Every weekend, Maroon does his own version of a triathlon, swimming one to two miles, biking 50 to 75 miles and running between eight and 15 miles in one day. Last weekend, it was a 1.5-mile swim, 75-mile ride and 12-mile run. "The problem is I have to double that for Hawaii," Maroon said. Maroon, who is the Steelers' neurosurgeon, is in training for the Ford Ironman World Championship in Kona, Hawaii, this October. The race consists of a 2.4-mile open-ocean swim, 112 miles of biking and 26.2 miles of running. Maroon is 67 years old and will be 68 at the time of the race. A year ago, Maroon's colleagues were telling him his racing career was over.

The trouble started five years ago, when the Sewickley resident was competing in his fifth Ironman race and injured

his left knee. He continued to race, but his last major competition was in 2005, when he finished in sixth place in his age group in the triathlon at the Senior Olympics, held in Pittsburgh. Last year, Maroon was told by two orthopedic surgeons that he was going to need a knee replacement. That was unacceptable. "They told me if I had an artificial knee, I'd never run again," Maroon said. "I could walk, but I'd never run again." Maroon started researching on the Internet and found Dr. Christopher Centeno and his Colorado-based company, Regenerative Services. Centeno developed a procedure called Regenexx, in which he extracts stem cells from a patient's own bone marrow, cultivates them, then injects them into the affected area to regenerate bone and cartilage.

Eight months ago, Maroon got the first of two injections into his left knee, and last weekend he completed a half-Ironman distance race in Muncie, Ind. He finished fifth in his age group and qualified for the Ironman World Championship in the process. The procedure, which costs \$5,000 to \$7,000, is not covered by insurance. Maroon knows of no one in the Pitts-

burgh area doing similar work. Centeno said that while his typical patient is active and between 40 and 60 years old, Maroon will be the first to go on to compete in an Ironman. "I kid Joe that I think he's the biggest overachiever that I know," Centeno said. "We're thankful he did well." In 2007, nearly 1,700 athletes competed in the Ironman World Championship, ranging in age from 19 to 78, with an average age of 37. In 2007, 23 men competed in the 65-69 age group. Only 32 others competed in higher age groups, 70-74 and 75-79. Blair LaHey, director of communications for Ironman, said they've seen an increase in their 60-plus age groups, and a few years ago they had their oldest athlete cross the finish line in Hawaii at 80 years old. "We continue to be amazed at the number of athletes in the 60-plus age divisions, not only in their involvement but in their continued participation," she said. "It's a testament not only to their fitness but also to them continuing to challenge themselves and continuing to add accomplishments to their life's to-do list." This will be Maroon's third trip to Kona. "I started 20 years ago doing triathlons," he said. "Each year I just increased the bar, just like I do with my training now. That's the remarkable thing about it; you see what your body can do and adjust to."



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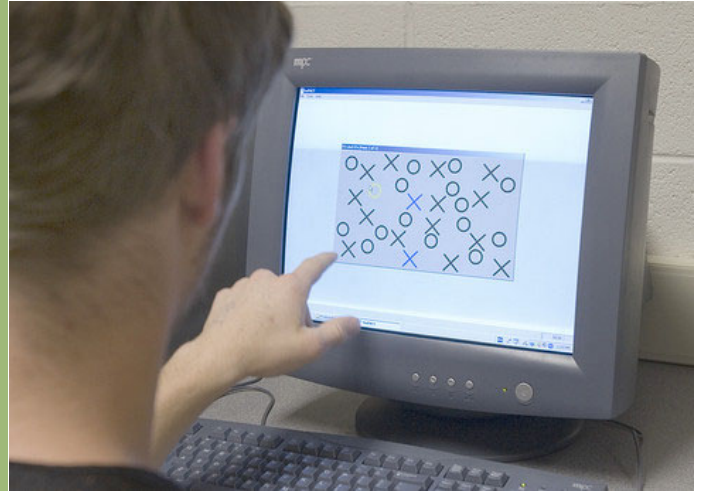


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Misconceptions About the Use of Neurocognitive Testing in Sports



The initial impetus for the development of the ImpACT test battery during the 1990's was the obvious need for a brief, repeatable test battery. Through my initial work with professional athletes, it became increasingly clear that the continued use of traditional "paper and pencil" test batteries were impractical for use with the largest segment of athletes who might require our services – children and adolescents. Most high schools simply cannot afford the approximate 40 hours of face to face administration time to complete baseline testing. Furthermore, as discussed above, there are not currently enough neuropsychologists to perform this service, even if there were sufficient funds to pay for the service.

There has been a great deal written lately in the popular media recently about the use of neuropsychological testing in sports – some of it accurate, some of it distorted and some of it completely wrong. This media exposure has no doubt been fueled by the recent mandate from NFL Commissioner Goodell's office to require neuropsychological testing of all players in the league. I have listed below some of the misconceptions regarding the use of neuropsychological testing in sports:

"There is no scientific data that demonstrates the use of neuropsychological testing in sports"

Currently, there are over 50 scientific articles that have explored various aspects of reliability and validity of the ImpACT test battery. An increasing number of these studies have been completed by researchers who are completely independent from ImpACT or from the University of Pittsburgh.

"Using computer-based testing limits the involvement of the neuropsychologist in the care of athletes"

Quite the contrary, we believe that the ImpACT program provides an excellent opportunity for neuropsychologists to become involved in sports neuropsychology. Currently there are over 100 neuropsychologists performing this type of service, utilizing ImpACT.

"The use of ImpACT diminishes the role of the medical team in managing the concussion"

Throughout the development of the ImpACT program, we have clearly emphasized that ImpACT is a *tool* and as such represent one aspect of concussion management. It has *never* been designed to be used independently to make decisions regarding the diagnosis of concussion or return to play. Consistent with recent international management guidelines, the UPMC concussion management model is based on a multi-disciplinary model that includes Athletic Trainers, Physicians, Psychologists and Neuropsychologists.

This is currently an exciting time in the development of concussion management services. Indeed, the next few years are likely to galvanize the role of sports neuropsychology for the next twenty years and we believe that the judicious use of computer-based tools such as ImpACT can play an important role in the development of scientifically based concussion management.

Coming Soon:

- **ImPACT Training via Internet**
(Beginners thru Advanced)
- **Clients Only Webinars (IT, Billing, Clinical Management, PR, and Marketing)**
- **Online Client Resource Center**

Journal of Athletic Training Article:

Concussion in Sports: Postconcussive Activity Levels, Symptoms, and Neurocognitive Performance

J Athl Train. 2008 May-Jun;
43(3):265-74

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Context: Evidence suggests that athletes engaging in high-intensity activities after concussion have more difficulties with cognitive recovery.

Objective: To examine the role post injury activity level plays in postconcussive symptoms and performance on neurocognitive tests in a population of student-athletes.

Design: Retrospective cohort study with repeated measures of neurocognitive performance and symptom reporting.

Setting: University-based sports concussion clinic.

Patients or Other Participants: Ninety-five student-athletes (80 males, 15 females; age = 15.88 +/- 1.35 years) were retrospectively assigned to 1 of 5 groups based on a post injury activity intensity scale.

Main Outcome Measure (s): We employed a regression analysis for repeated measures to evaluate the relationship of activity intensity to symptoms and neurocognitive outcome up to 33 days after concussion. Postconcussion symptom scores and neurocognitive (verbal memory, visual memory, visual motor speed, and reaction time) scores served as the primary outcome measures.

Results: Level of exertion was significantly related to all outcome variables ($P < .02$ for all comparisons). With multivariate analysis, activity intensity remained significant with respect to visual memory ($P = .003$) and reaction time ($P < .001$).

Conclusions: Activity level after concussion affected symptoms and neurocognitive recovery. Athletes engaging in high levels of activity after concussion demonstrated

worse neurocognitive performance. For these tasks, those engaging in moderate levels of activity demonstrated the best performance.

Key Words: exertion, rehabilitation, mild traumatic brain injury, student-athletes

Key Points

- Symptom status and neurocognitive performance were affected by postconcussive activity levels and age and sex of the athlete.
- Younger adolescents experience more pronounced deficits in verbal and visual memory than older teenagers after concussion.
- Moderate levels of exertion were associated with better symptom and neurocognitive prognosis, suggesting controlled exertion may improve outcome after concussion. More study in this area is needed.



CIC NEWS



COLLABORATION TAKES CONCUSSION 'EPIDEMIC' HEAD ON: Statewide Group to Improve Education, Identification, Diagnosis and Treatment

Seven medical organizations in Wisconsin, along with several advocacy groups and sports organizations, have created a statewide voluntary group committed to improving concussion care for athletes in the state. The **Wisconsin Sports Concussion Collaborative (WSCC)** aims to promote the health, safety and academic performance of Wisconsin student-athletes and others by improving the education, identification, diagnosis and treatment of concussions.

“This collaboration is a national model,” said Kevin Walter, MD, program director of pediatric and adolescent sports medicine at Children’s Hospital of Wisconsin and a member of the medical advisory board for WIAA and the National Federation of State High School Associations. “It is exciting to work with other doctors who are very interested in concussions. In high school football in Wisconsin, 15 percent of the athletes will suffer a concussion in one year. That is about 4,000 to 5,000 kids, and that does not include other contact sports like soccer, wrestling, hockey or basketball. A concussion is a brain injury; injured athletes need to be seen by a doctor.”

The WSCC founding members include ThedaCare Orthopedics Plus in Appleton; UW Health-Sports Medicine in Madison; Children’s Hospital of Wisconsin in Milwaukee; Gunderson Lutheran in LaCrosse; Bellin Health-Sports Medicine in Green Bay; Froedtert Health-Sports Medicine in Milwaukee; and Ministry Health Care-Sports Medicine in Stevens Point. Recently the Collaborative added new members from Menomonie, Eau Claire and Wausau, and would like to add more members. Information on the group can be found at www.WIsportsconcussion.org on the web.

“Concussions in athletes are a much more serious problem than has been recognized in the past,” said Mark Hallett, MD, director of sports medicine for ThedaCare Orthopedics Plus. “We now recognize that getting your ‘bell rung’ is a brain injury that can take several days or more to heal. Recent studies show that they are more common and take longer to heal than previously thought; it is an epidemic. This can result in an increased risk of repeated concussions, prolonged symptoms, decreased academic performance, and potentially permanent disability. This should concern everyone associated with sports as well as organizations that deal with brain injuries.”

In addition to educational resources and a listing of trained health care providers, the Collaboration offers an online ImPACT™ concussion test readily available for use for baseline testing prior to an athlete’s participation. ImPACT is a computerized series of neurocognitive tests that help medical staff determine the severity of concussions and when it is safe for injured athletes to return to play. The ImPACT program has been adopted by team doctors and certified athletic trainers for numerous top sports leagues in the world, including the National Football League, National Hockey League and Major League Soccer. Concussion is any change in mental status caused by a sudden violent rocking back and forth of the brain inside of the skull due to a blow to the head or upper

body. Symptoms can include headache, amnesia, dizziness, confusion, lack of hand-eye coordination, and in some cases, loss of consciousness. Generally, an athlete can safely recover from an initial concussion as long as the brain has had time to heal. If a second concussion occurs prior to full recovery from the first, an athlete may experience long-term symptoms in the form of chronic headaches, sleep difficulties, personality changes or memory problems. In rare cases, a second concussion may even result in death from second impact syndrome.

“This innovative tool is extremely beneficial to soccer athletes, coaches and parents and can help us objectively determine when full recovery from concussion has occurred,” said Peter Mariahazy, president of Wisconsin Youth Soccer Association. “By getting the baseline test of each athlete, the coaches and the parents know when it is safe to send the athlete back out onto the field. They may think they know, but this will tell them for sure. If an athlete had a sprained ankle, a coach would not send him or her out to play too soon and risk aggravating the injury. That should be the same with a concussion. You want to make sure the athlete is healed.”

ImPACT objectively measures multiple aspects of brain functions, including verbal memory, visual memory, processing speed, reaction time and post-concussive symptoms. In the pre-season, each athlete should take 20-30 minutes to complete a baseline test, which shows how the athlete’s healthy brain processes information. When a concussion is suspected, a follow-up test can be administered to see if the results have changed from the baseline. This comparison helps to more accurately diagnose and manage the concussion. Follow-up tests can be administered over days or weeks so that medical professionals and clinicians are able to continue to track the athlete’s recovery from the injury.

“It is important to obtain accurate baselines so we understand where the athlete functions during normal day-to-day activities prior to sustaining a head injury,” said David Bernhardt, MD, with UW-Health’s Department of Pediatrics/Ortho & Rehab, Division of Sports Medicine. “If the athlete subsequently sustains a head injury, we can compare the two studies, which will not only help in determining clearance for return to play decisions but may also give us a picture of how the athlete may function in the classroom after the head injury.”

The Wisconsin Sports Concussion Collaborative and WIsportsconcussion.org is co-lead by Dr. Hallett, who serves as the medical director and lead physician, and Tracy McCormick, who serves as a concussion program consultant, sales and support specialist, and web master for the organization. For more information, MEDIA may contact Megan Wilcox (megan.wilcox@thedacare.org), public relations specialist for ThedaCare, at (920) 830-5847, or pager (920) 554-0730, or Tracy McCormick (tracy.mccormick@WIsportsconcussion.org) at (920) 380-1541. ###



CIC NEWS



Free Baseline Testing to All in Indiana

Recently, you may have heard about the email from Bobby Cox, Indiana High School Athletic Association (IHSAA) Assistant Commissioner, describing the IHSAA's partnership with Clarian Health, Methodist Sports Medicine / The Orthopedic Specialists (MSM / TOS) and the ImPACT concussion management program.

As an established part of Indiana's sports medicine community, MSM / TOS physicians have treated both orthopedic and sports medicine conditions including sports-related concussions. Team physicians have witnessed the frequency of student and professional athletes who have suffered concussions and the potential for devastating consequences when they return to play prematurely.

Because Clarian Health and MSM / TOS firmly believe that concussion management programs are an important part in the evaluation and treatment process for athletes who receive concussions, Clarian has agreed to cover the cost to provide baseline ImPACT testing for high school athletes in Indiana.

The ImPACT concussion management program provides objective data to assist in making sound return-to-play decisions for athletes who have suffered a concussion. Athletes take a 20-minute, computer-based baseline ImPACT test during preseason.

The baseline measures an athlete's brain function based on answers to self-reported symptoms and results of neurocognitive tests that measure reaction time, coordination, mental status, etc. Comparing post-injury ImPACT test results with the athlete's baseline data provides information which is a valuable part of the evaluation process in making return to play decisions. For more information on ImPACT, go to www.impacttest.com

MSM / TOS physicians are leading the way in the formation of the Indiana Sports Concussion Network—physicians trained to interpret the ImPACT test and manage concussions. We believe that whenever possible, athletes should be able to receive follow-up concussion care in their own communities, as close to home as possible.

There is no cost to you, your high school, or the athletes for the administration of this baseline ImPACT test; all costs are being funded by Clarian Health and its Clarian Human Motion musculoskeletal program. To provide these free assessments for your athletes, either you or a staff member will be able to be trained to use the ImPACT software to administer the test to your athletes. (The training is very simple and takes one to two hours.) We are currently coordinating a series of training sessions at various sites around Indiana. There is no cost for the training.

We hope that you will want to take advantage of this special opportunity available to your athletes.

Please email Kirsten Bondy, ATC @ kbondy@methodistsports.com if you are interested. Once we learn of your interest, we will send you more information about the training sessions available. We look forward to working with you, your school and your athletes on this program.



CIC NEWS

NEWSLETTER CASE PRESENTATION
SUBMITTED BY:



In a state where rough-and-tumble sports like football rank high among people's favorite pastimes, Summer Schnakenberg-Ott has found the perfect place to make a personal impact.

Last September, the University of Central Missouri alumna became clinical director of the newly established CHRISTUS St. John Sports Medicine Concussion Center in Nassau Bay, TX. As director, she heads up a one-of-a-kind comprehensive concussion center that treats head injuries and provides an individualized approach to concussion management with clinical oversight and care.

The center serves 11 different 2A to 5A high schools and a host of other athletes while also assisting adult workers, the elderly and others who have sustained concussions. As Schnakenberg-Ott says, "The question parents of younger athletes come in with is 'when can my kid go back to playing sports?' For someone who is middle-aged or an older adult, the question is, 'when can I return to work and my normal activities?'"

Although the work is challenging, the young neuropsychologist enjoys the opportunity to put her education and experiences to good use. Her services are particularly needed in a community where so many young people are involved in high-collision sports. "It's really been rewarding," she says. "I've received a lot of positive feedback from the hospital, and many parents throughout the community have given us good information about how we have helped their kids. It's neat to see how all the years I've trained is helping kids and other folks."

While putting concussion victims on the road to recovery, Schnakenberg-Ott is gaining recognition from her alma mater. The UCM Alumni Association plans to honor her during May 2008 commencement exercises as Outstanding Recent Alumnus. The award is given to an individual who has earned an undergraduate or graduate degree from Central Missouri within the past 10 years. Criteria include professional and volunteer accomplishments, integrity, stature and demonstrated ability and renown.

After growing up in Cole Camp, Schnakenberg-Ott attended State Fair Community College in Sedalia, MO, then came to UCM, where she completed a Bachelor of Science in 1999 and a Master of Science in 2001, both in psychology. While pursuing her education, she became heavily involved with research in neuropsychological assessment, worked on a number of faculty grants and received the Outstanding Graduate Student in Psychology Award. Shortly after earning a master's degree, she served as an adjunct faculty instructor for general psychology courses at UCM and State Fair.

Her experience on campus as a graduate and undergraduate student also led to positive working relationships with faculty mentors, which continue today. This includes close collaboration with UCM psychology professors

When Heads Collide

David Kreiner and Joseph Ryan on research projects that resulted in several co-authored publications in scholarly journals.

Used to taking on new challenges, Schnakenberg-Ott spent two years as a post doctoral fellow in neuropsychology at the University of Pittsburgh Medical Center. While working with renowned sports neuropsychologist, Mark Lovell, Ph.D., she got involved with post concussion evaluation and management of athletes at all levels of play."

As she was wrapping up her fellowship, she was recruited to Texas, where she hoped to build upon her experiences in Pittsburgh. The position may have been intimidating, she says, had it not been for the positive support she received throughout her education and today by her long-time college mentors. Schnakenberg-Ott follows their lead by offering the same type of support for students who contact her for advice.

"My educational experience at UCM continues to provide me with personal and professional enrichment," she says. "I am presently in contact with several psychology graduate students from UCM and provide guidance and mentorship particularly for those students interested in pursuing doctoral study beyond undergraduate or master's degrees. I appreciate the interaction I have with UCM students as it is my opportunity to give back for all the guidance and support I was given as a student."

Reprinted with permission: UCM Alumni Today. Spring 2008. Written by Jeff Murphy.

Some of Dr. Ott's accomplishments since starting the Concussion Center at CHRISTUS St. John:

- CHRISTUS St. John Concussion Center was the first to offer ImPACT testing in the Bay Area Houston.
- Dr. Ott provides services for 11 area 2A-5A high schools in addition to various club sport participants.
- Dr. Ott has provided pre and post injury assessment for the Houston Areas Hockey Team
- Participates in national conference poster presentations and invited lectures including the Department of Orthopedic Surgery and Rehabilitation 26th Annual Conference on Innovations in Sport Medicine, South Padre Athletic Training Seminar, and Central Texas Sports Medicine Seminar.
- Currently a co-investigator on a research project assessing the effect of exercise on neurocognitive functioning and symptom presentation in TBI patients as measured by ImPACT. Dr. Ott is also a co-investigator on a project which will focus on the neuropsychological status of sleep apnea patients following use of oral dental appliances.
- Recently appointed Clinical Professor at University of Texas Medical Branch (UTMB) in the Department of Neurology.
- In May of 2008, honored at the University of Central Missouri commencement ceremonies as Outstanding Recent Alumnus.

Case Presentation on next page was submitted by Dr. Ott.

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CLINICAL EVALUATION
CASE STUDY
SEPTEMBER 2008 NEWSLETTER



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CLINICAL EVALUATION: CASE STUDY

CEREBRAL CONCUSSION IN A FEMALE HOCKEY PLAYER: A CASE PRESENTATION

**PRESENTED BY:
SUMMER D. OTT, PSY.D., DREW WROBLEWSKI, MICHAEL W. COLLINS, PH.D.
UPMC SPORTS CONCUSSION PROGRAM**

INJURY DESCRIPTION AND PATIENT BACKGROUND:

“C” is a 19 year old, right-handed, female college hockey player who sustained a concussion on January 13, 2007 and was seen in clinic for initial evaluation on April 05, 2007 (82 days post-injury). Regarding the injury, “C” was playing in a hockey game when she was checked from behind. Subsequently, she lost her balance and fell backwards striking her helmeted head to the ice. Acute markers of injury revealed a loss of consciousness for a few seconds. In addition, the patient experienced a 30 second period of retrograde amnesia, as well as a 5 minute period of post-traumatic amnesia. Immediate symptoms included a severe posterior pressure headache, visual changes, fatigue, balance difficulties, nausea, -slowed thinking, phonophobia, photosensitivity, and irritability. Following the injury, “C” was taken to a local emergency room, where a CT scan of the head was conducted and characterized as normal. The patient was discharged home. Because the patient’s post concussion symptoms were severe, she stayed out of school and hockey participation for approximately two weeks. “C” was evaluated 9 days post injury (01/22/07) by a campus physician. She was permitted to return to school, yet instructed to remain out of hockey. On January 26, 2007, “C” followed up with her Primary Care Physician (PCP), and while still symptomatic, she was cleared to play hockey in that evening’s game. Upon her return to play, “C” experienced significant levels of dizziness, and therefore, removed herself from play. On February 02, 2007, “C” returned to hockey and played in 3 more games. During that time, the patient continued to experience concussion symptoms and noticed a decline in her academic performance. Prior to the injury, “C” had a 3.6 GPA, which dropped to a 2.5 GPA in the term following her concussion. She missed several classes due to her ongoing symptomatology. She played her last game on February 24, 2007. “C” was ultimately removed from hockey at the discretion of her family and coach. Attempts to resume physical exertion resulted in a worsening of symptoms.

FIRST CLINICAL EVALUATION (82 DAYS POST-INJURY).

“C” was self-referred to our clinic. During the first evaluation, she continued to report increased levels of fatigue and a posterior, pressure-type headache that was rated a 6 on a 10 point severity scale. The patient reported that her headaches were also frequently associated with photosensitivity, phonophobia, mild nausea, and neck pain. Headaches reportedly worsened in the afternoon and were strongly associated with increased levels of cognitive or physical activity. “C” was also exhibiting gross levels of dizziness and disequilibrium. Cognitively, the patient endorsed perceived neurocognitive difficulties, including, short term memory deficits, and slowed thinking. From a mood standpoint, “C” described herself as more irritable since the injury.

Medical/Psychosocial History:

The patient’s medical history was generally unremarkable and noncontributory. There was no known prior history of concussion or neurological disorder. “C” denied any history of personal or family psychiatric illness. Regarding educational history, “C” described herself as

an “A” student and typically performed in the high average to superior range on standardized tests. There was no history of learning disability, failed grades, attentional concerns, or speech therapy.

Test Results:

Upon evaluation, “C” did exhibit a positive Romberg. Moreover, she exhibited significant postural sway and complained of dizziness. There was also evidence of mild endpoint nystagmus. Motor abilities appeared intact. “C” was administered ImPACT as part of the initial post-injury evaluation. The patient had not participated in a pre-injury baseline. Premorbid estimates of cognitive functioning placed the patient in the above average to superior range. Relative to her expected pre-injury cognitive performance, current scores on ImPACT fell below expected levels. Specifically, the patient’s performance was significantly impaired in the areas of verbal memory, visual motor speed, and reaction time (all scores • 1st percentile). “C” also demonstrated poor visual memory scores, with performance falling at the 6th percentile (borderline range). On the Post Concussion Symptom Scale (PCSS), “C” endorsed a significant number of symptoms (total symptom score = 92).

Impressions & Recommendations:

Based upon the patient’s symptom presentation and cognitive deficits, it was the impression of the clinicians that “C” was experiencing post-concussion syndrome. This was likely exacerbated by a premature return to play, as well as persistent physical and cognitive exertion. ImPACT test results revealed cognitive deficits which likely contributed to her academic decline. The following recommendations were made for management of her case:

1. It was recommended that “C” remain out of school until her next evaluation in order to expedite recovery.
2. The patient was instructed to remain out of hockey. Furthermore, it was suggested that “C” avoid physical exertion.
3. Given her continued disequilibrium and dizziness, a referral for a vestibular therapist was provided.
4. An MRI of the brain was recommended to rule out structural pathology.

SECOND CLINICAL EVALUATION (97 DAY POST INJURY).

“C” returned for re-evaluation approximately two weeks after the initial consultation. “C” underwent an MRI of the brain which was unremarkable. She was also evaluated by a vestibular therapist who determined that the patient was experiencing “significant disequilibrium and postural instability.” Additionally, she was “evidencing signs of vestibular ocular reflex.” Thus, it was recommended by her vestibular therapist that she attend vestibular therapy once a week for approximately 8-12 weeks. Her suggested therapy would entail balance and gait training, functional training, sensory organization training, eyes/head coordination exercises, and eventually a home exercise program. Considering other recommendations during the previous visit, “C” remained out of school and was fairly sedentary. With this level of reduced activity, the patient experienced a decrease in symptoms, although difficulties with headaches, balance problems, dizziness, fatigue, and blurred vision persisted. Headaches were reportedly less frequent, although they continued to worsen in the afternoon and evening hours. “C” also reported difficulty falling asleep. In terms of emotional functioning, the patient continued to perceive herself as more irritable since the injury. Cognitively, “C” reported continued difficulty with memory functioning, attentional abilities, and information processing.

Test Results:

“C” was again evaluated via ImPACT. Her data was compared to normative values and also to her scores from the initial evaluation. Although, “C” demonstrated subtle improvement in her verbal memory and visual motor speed scores, her overall performance on ImPACT was reflective of significant neurocognitive difficulties. Her verbal memory and visual motor speed composite scores fell at the 2nd percentile (impaired range). Reaction time scores remained in the impaired range at the 1st percentile. There was no observable change with respect to the patient’s visual memory scores, with performance at the 6th percentile (borderline range). When compared to the previous evaluation, “C” endorsed an improvement in symptoms. However her total symptom score on the PCSS was 76, reflective of a severe degree of symptomatology.

Impressions & Recommendations:

Given that the patient was approximately 3 months post injury, and there had been little demonstrable improvement in her cognitive test scores, it was clear that “C” was experiencing a protracted recovery. Considering the patient’s lingering physical symptoms and neurocognitive deficits, a return to hockey participation was strongly discouraged. The following recommendations were made for management:

1. Continue with vestibular therapy as recommended.

2. A return to college at this time would only exacerbate her symptoms and further prolong recovery. Therefore, "C" was encouraged to meet with her college guidance counselor to medically withdraw from her courses.
3. "C" was encouraged to remain fairly non-exertional. If her symptoms improved, walking for exercise would be permissible.
4. A headache diary, in which the patient could document her headaches in terms of triggers, duration, severity, frequency, associated activity, etc. was also suggested. It was believed that this information would be helpful in determining tolerable activities as "C" recovered.
5. The patient was instructed to return for follow-up in 2 weeks.

THIRD EVALUATION (111 DAYS POST-INJURY).

"C" returned for her third evaluation. Overall, the patient reported improvement with respect to her symptoms. "C" attended 4 sessions of vestibular therapy and acknowledged that disequilibrium, dizziness, and headaches improved as a result of this therapy. "C" continued to experience posterior-based headaches that were associated with light and noise sensitivity. She continued to report at least mild levels of fatigue. From a cognitive standpoint, "C" reported mental fogging, short term memory deficits, and slowed thinking. Because the patient perceived some improvement in her symptom status, she returned to 1 college course. Emotionally, "C" reported moderate degrees of anxiety and irritability. She had remained fairly sedentary, refraining from any formal physical activity.

Test Results:

"C" was administered ImPACT, and improvement was observed across all four composite scores. More specifically, her verbal memory scores improved from the 2nd percentile (impaired) to the 5th percentile (borderline). Visual memory scores improved from the 6th percentile (borderline) to the 12th percentile (low average). Demonstrable improvement was seen in the areas of visual motor speed and reaction time, which were impaired during her previous evaluation. Visual motor speed and reaction time scores fell at the 27th (lower extreme average range) and 59th (average) percentiles, respectively. On the PCSS, the patient's symptom score was remarkably decreased when compared to the previous evaluation (total symptoms score=43).

Impressions & Recommendations:

"C" demonstrated tremendous progress since her previous evaluation. She reported a reduction in her symptoms, and her vestibular functioning was improved as a result of her participation in vestibular therapy. ImPACT results also revealed improvements, particularly in the areas of reaction time and visual motor speed, when compared to her previous evaluations.

Of predominate concern for the patient as this point was the presence of anxiety and irritability. The following recommendations were made for management:

1. Given her reported levels of anxiety and irritability, it was determined that "C" may benefit from an anti-depressant such as Lexapro. Therefore, she was referred to a Sports Medicine PCP at the UPMC Center for Sports Medicine to oversee this potential medication regimen.
2. Although the patient made considerable progress, she was not fully recovered from her concussion as evidenced by lingering migrainous headaches, fatigue, and neurocognitive deficits. Thus, "C" was not cleared to return to any contact sport activity.
3. The patient was told that she may resume low levels of physical activity as tolerated. Recommendations for activity included walking, light jogging, stationary bike, and swimming. She was advised to immediately discontinue any activity which produced a reoccurrence of symptoms.
4. "C" was instructed to continue with vestibular therapy as previously recommended.
5. The patient was advised to return for re-evaluation in 3-4 weeks.

FOURTH EVALUATION (159 DAYS POST-INJURY)

At this evaluation, "C" no longer exhibited any signs of disequilibrium or reported any dizziness. She had been cleared from vestibular therapy. On average, she was running 1 mile twice a week. On occasion, she noticed a slight, frontal-based headache (rated 2-3 on a 10 point severity scale) and photosensitivity. She stated that she discontinued activity once the symptoms onset. Following discontinuation of activity, she denied any interim headaches, photosensitivity, etc. At rest, "C" was completely symptom free with the exception of some mild short term memory problems and mental fatigue. She was able to complete her college course without significant difficulty. During the

previous evaluation, "C" acknowledged some increased levels of anxiety and irritability, and did receive a prescription for Lexapro (5mg) from a Sports Medicine PCP. Since taking the antidepressant, "C" reported significant improvement in her emotional status. The patient had enrolled for a 5-week study abroad program which would require her to take two college courses. In terms of hockey participation, "C" expressed a desire to return to playing hockey with her team in the fall of 2007.

Test Results:

"C" was again administered ImPACT. Verbal memory and visual memory scores remained commensurate with the previous evaluations falling at the 5th (borderline) and 15th (low average) percentiles, respectively. Little change was observed with respect to visual motor speed, with current scores falling in the low average range (19th percentile). Reaction time scores fell in the lower extreme of the average range (33rd percentile). On the PCSS, "C" endorsed mild symptoms of sleeping more than usual, nervousness, and irritability (total symptom score = 3).

Impressions & Recommendations:

"C" continued to recover from her concussion as evidenced by cognitive deficits on ImPACT. Overall, her data remained stable. From a symptom standpoint, the patient was generally symptom free at rest. She denied any interim vestibular deficits. However, she reported a recurrent mild headache and photosensitivity with running. This was controlled by immediately discontinuing activity. Based upon her continued deficits on ImPACT, as well as exertion-related symptomatology, "C" was not cleared for any formal sport participation. The following recommendations were made for management:

1. "C" was instructed to continue antidepressant therapy as prescribed by the PCP.
2. The patient was encouraged to participate in low levels of aerobic activity as tolerated. Should her headaches abate completely, "C" was instructed to increase exertional levels.
3. "C" was cleared to study abroad and participate in academic coursework. If symptoms returned with increased levels of cognitive activity, "C" was advised to take frequent breaks and monitor her activity carefully in an effort to avoid overtaxing herself. Academic accommodations were also suggested in the form of un-timed tests, pre-printed class notes, and the use of recording devices to aid in memory recall and retrieval.
4. It was recommended that "C" return to clinic in two months, prior to the start of her fall semester for re-evaluation. If the patient continued to improve, a return to hockey would be discussed at that time.

At the time of publication of this case report, we continue to monitor "C's" progress. Please refer to table for the patient's ImPACT data.

SUMMARY & KEY MANAGEMENT STRATEGIES:

This case raises some important issues regarding concussion management and recovery. Although a standard protocol based on recommendations put forth by the *Concussion in Sport Group* (Aubry et al., 2002) was followed by our clinic for the treatment of the athlete, "C" did not undergo neurocognitive testing until approximately 82 days post-injury. The patient was symptomatic, yet was cleared to return to hockey by her PCP. She played 5 games and continued to participate in strenuous exertional activities while grossly symptomatic. It is likely that this level of activity prolonged her recovery. Of course, this raises the issue that, had she been removed from play and properly managed, perhaps her symptoms would have been short-lived and cognitive deficits less pronounced.

Another issue this case raises is the patient's level of vestibular dysfunction. It is unknown whether significant levels of disequilibrium played a role in her slowed recovery. Literature involving recovery rates of concussed patients with post-traumatic vertigo is scant. Therefore, if the clinician suspects the presence of vestibular dysfunction, a referral to a vestibular therapist or specialist for evaluation is recommended.

"C's" vulnerability for re-injury is unknown. Given her lengthy recovery from this injury, it is possible that the athlete's vulnerability may be higher than the average individual. It is also possible that "C" could become more easily concussed with less biomechanical force. A thorough discussion with the athlete and her family regarding the short and long-term risks of a return to hockey will occur. However, before the athlete can be cleared to resume contact sport participation, she must remain symptom free at rest, demonstrate that she is completely symptom free with heavy levels of exertion and light contact, and lastly, exhibit normal scores on cognitive testing (e.g., ImPACT).

This case also illustrates the importance of a multi-disciplinary approach to concussion management which, in this case, included neuropsychologists, a sports medicine PCP, and a vestibular therapist. Additional support systems also included the patient's coach, teammates, family, and college professors. Without continued support for academics and health, an athlete might experience undue pressure to prematurely return to a sport or to classroom instruction.

There may be an increased proclivity for emotional changes following a concussion (Broshek et al, 2004; Iverson & Gaetz, 2004). Psychological symptoms, if left untreated, could certainly play a role in exacerbating cognitive deficits and prolonging spontaneous recovery. By the third evaluation, "C" began to report anxiety and irritability. In this particular case, we were able to address the athlete's emotional symptoms fairly quickly in order to prevent further slowing of her recovery. Therefore, clinicians should be aware of the possibility of emerging emotional symptoms, such as depression and anxiety, so appropriate referrals for treatment (pharmacotherapy or psychotherapy) can be made.

While this case report does contribute to the literature involving management and care of a female athlete, there is a lack of scientific research regarding recovery in female athletes from concussion. At present, very limited research has been performed comparing concussion rates and recovery times of men and women. The established protocol for treatment and management of concussion is mainly derived from data from and clinical experience with male athletes. It is assumed that female athletes display similar recovery rates and symptoms, but there is a lack of data to support this claim. At baseline, females report more symptoms than their male counterparts (Lovell et al, 2006) and females have been found to have a higher incidence of depression (Fenton et al., 1993; Schopp et al., 2001) following a mild traumatic brain injury. Studying gender differences in concussion recovery would provide better empirical evidence upon which to base clinical evaluations and management. However, regardless of any identified factors that influence recovery (e.g., age, gender, concussion history, mechanism of injury, acute markers etc.), this case demonstrates that individual differences exist among all concussed athletes, and acknowledgement of these differences is important when managing the injury. Additionally, this case report further reiterates the importance of neuropsychological testing and symptom inquiry following a concussion in order to make objective decisions regarding safe return to play.

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C H

Organization: University
 Subject ID#: 111-11-1111

Date of birth:	08/01/87	Age:	20
Gender:	Female	Height:	67 inches
Handedness:	Right	Weight:	135 lbs

Native country / region:	United States of America	Second language:	(None)
Native language:	English	Years speaking:	0

Years of education completed excluding kindergarten:	13	Received speech therapy:	No
Diagnosed learning disability:	No	Problems with ADD/Hyperactivity:	No
Attended special education classes:	No	Repeated one or more years of school:	No
Type of student:	Above Average		

Current sport:	Hockey	Current level of participation:	Collegiate
Primary position/event/class:		Years experience at this level:	0

Number of times diagnosed with a concussion (excluding current injury):	0
Concussions that resulted in loss of consciousness:	0
Concussions that resulted in confusion:	0
Concussions that resulted in difficulty remembering events that occurred immediately after injury:	0
Concussions that resulted in difficulty remembering events that occurred	0
Total games missed as a result of all concussions combined:	0

Concussion history: 01/13/2007

Treatment for headaches by physician:	No	Treatment for psychiatric condition (depression, anxiety):	No
Treatment for epilepsy / seizures:	No	Treatment for migraine headaches by physician:	No
History of brain surgery:	No	Treatment for substance/alcohol abuse:	No
History of meningitis:	No		



Exam Type		Post-injury	Post-injury	Post-injury	Post-injury	
Date Tested		04/05/2007	04/20/2007	05/04/2007	06/22/2007	
Last Concussion		01/13/2007	01/13/2007	01/13/2007	01/13/2007	
Exam Language		English	English	English	English	
Test Version		4.5.805	4.5.805	4.5.805	4.5.805	
Normative Comparison Group		F 19-30	F 19-30	F 19-30	F 19-30	

Composite Scores *									
Memory composite (verbal)		59	1%	63	2%	77	5%	79	5%
Memory composite (visual) †		56	6%	54	6%	61	12%	63	15%
Visual motor speed composite		23.15	1%	23.88	2%	35.08	27%	33.38	19%
Reaction time composite		0.88	<1%	0.75	1%	0.53	59%	0.57	33%
Impulse control composite		0		0		7		5	
Total Symptom Score		92		76		43		3	

* Scores in bold type indicate scores that exceed the Reliable Change Index score (RCI) when compared to the baseline score. However, scores that do not exceed the RCI index may still be clinically significant. Percentile scores, if available, are listed in small type. Please consult your ImPACT User Manual for more details.

† Clinical composite score is available only for exams taken in ImPACT version 2.0 or later.

Concussion Details	
Date of concussion	01/13/2007
Loss of consciousness	1-20 seconds
Retrograde amnesia	11-59 seconds
Anterograde amnesia	31-180 minutes
Confusion / disorientation	> 30 minutes
Returned to play	
Taken to hospital	Yes
CT/MRI scan of head	Negative
Point of impact	Occipital, right
Mouthguard type	Multi-laminant
Mouthguard condition	Good
Mouthguard manufacturer	
Helmet manufacturer	
Helmet model	
Helmet size	
Symptoms	headache, dizziness or balance problems, visual changes, nausea, fatigue
Description of injury and additional information	

The information provided by this report should be viewed as only one source of information regarding the athlete's level of functioning. Diagnostic or return to play decisions should not be based solely on the data generated by ImPACT but should be based on an evaluation made by qualified medical personnel in accordance with usual and standard medical practice. If an individual is suspected of suffering a mild traumatic brain injury or concussion, this individual should be evaluated by medical personnel and should be followed carefully for the emergence of symptoms.

Consultation is recommended to help facilitate proper interpretation of the information provided by this report. For initial post-injury consultation you are urged to contact Dr. Mark Lovell or Dr. Micky Collins at ImPACT Applications. To reinforce proper interpretation of the test data, there will be no charge for the initial post-injury consultation.

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 lovellmr@upmc.edu

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 412-958-6714 (Pager)
 collinsmw@upmc.edu



Exam Type		Post-injury	Post-injury	Post-injury	Post-injury	
Date Tested		04/05/2007	04/20/2007	05/04/2007	06/22/2007	
Last Concussion		01/13/2007	01/13/2007	01/13/2007	01/13/2007	

Word Memory		WG = 2	WG = 3	WG = 4	WG = 5	
Hits (immediate)		11	12	10	12	
Correct distractors (immed.)		8	9	10	12	
Learning percent correct		79%	88%	83%	100%	
Hits (delay)		9	9	7	11	
Correct distractors (delay)		9	7	11	12	
Delayed memory pct. correct		75%	67%	75%	96%	
Total percent correct		77%	77%	79%	98%	

Design Memory						
Hits (immediate)		3	7	8	9	
Correct distractors (immed.)		10	4	6	8	
Learning percent correct		54%	46%	58%	71%	
Hits (delay)		9	8	9	9	
Correct distractors (delay)		8	9	4	6	
Delayed memory pct. correct		71%	71%	54%	63%	
Total percent correct		63%	58%	56%	67%	

X's and O's						
Total correct (memory)		6	6	8	7	
Total correct (interference)		94	95	127	123	
Avg. correct RT (interference)		0.77	0.76	0.41	0.46	
Total incorrect (interference)		0	0	7	4	
Avg. incorrect RT (interfer.)		0.00	0.00	0.26	0.31	

Symbol Match						
Total correct (visible)		26	26	26	27	
Avg. correct RT (visible)		2.01	1.49	1.20	1.62	
Total correct (hidden)		3	3	7	4	
Avg. correct RT (hidden)		1.92	1.58	1.76	1.39	

Color Match						
Total correct		9	9	9	9	
Avg. correct RT		1.19	0.98	0.78	0.72	
Total commissions		0	0	0	1	
Avg. commissions RT		0.00	0.00	0.00	0.53	

Three Letters						
Total sequence correct		0	4	3	4	
Total letters correct		10	12	11	14	
Pct. of total letters correct		67%	80%	73%	93%	
Avg. time to first click		3.10	3.18	2.03	3.41	
Avg. counted		7.6	8.0	12.8	13.6	
Avg. counted correctly		7.6	8.0	12.8	12.0	

Exam Type		Post-injury	Post-injury	Post-injury	Post-injury	
Date Tested		04/05/2007	04/20/2007	05/04/2007	06/22/2007	
Last Concussion		01/13/2007	01/13/2007	01/13/2007	01/13/2007	

Symptom Inventory (at time of exam)

Headache		5	4	1	0	
Nausea		2	1	0	0	
Vomiting		0	0	0	0	
Balance Problems		5	5	2	0	
Dizziness		6	5	0	0	
Fatigue		3	1	0	0	
Trouble falling asleep		5	3	1	0	
Sleeping more than usual		6	4	2	1	
Sleeping less than usual		0	0	0	0	
Drowsiness		4	5	1	0	
Sensitivity to light		6	6	4	0	
Sensitivity to noise		5	6	5	0	
Irritability		6	5	6	1	
Sadness		2	0	0	0	
Nervousness		5	4	6	1	
Feeling more emotional		2	1	3	0	
Numbness or tingling		4	0	0	0	
Feeling slowed down		6	6	2	0	
Feeling mentally foggy		6	6	3	0	
Difficulty concentrating		5	5	3	0	
Difficulty remembering		5	4	3	0	
Visual problems		4	5	1	0	
Total Symptom Score		92	76	43	3	

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Post-injury	Hours slept last night	
04/05/2007	Medication	
	Subject comments	
	Supervisor comments	

Post-injury	Hours slept last night	
04/20/2007	Medication	
	Subject comments	
	Supervisor comments	

Post-injury	Hours slept last night	
05/04/2007	Medication	
	Subject comments	
	Supervisor comments	

Post-injury	Hours slept last night	
06/22/2007	Medication	
	Subject comments	
	Supervisor comments	

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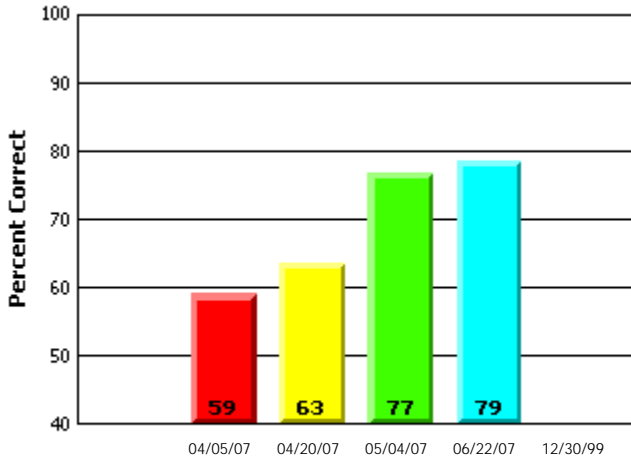
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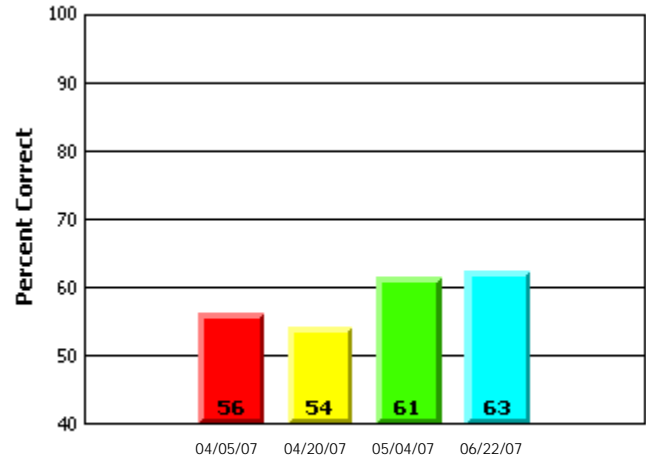
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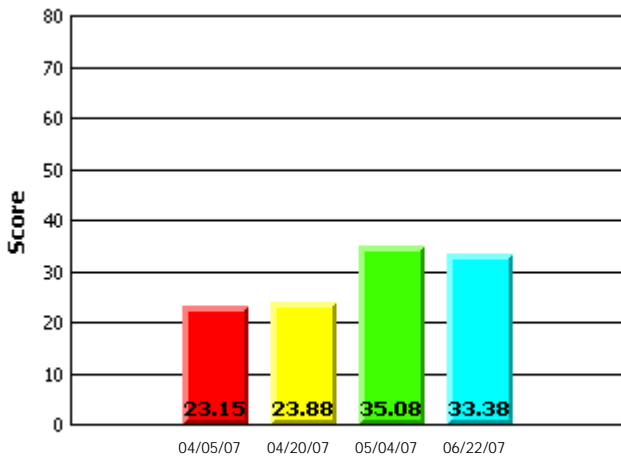
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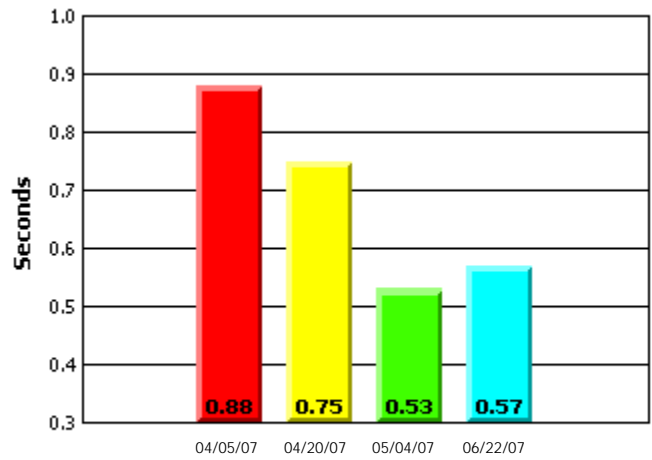
Memory Composite (Visual)



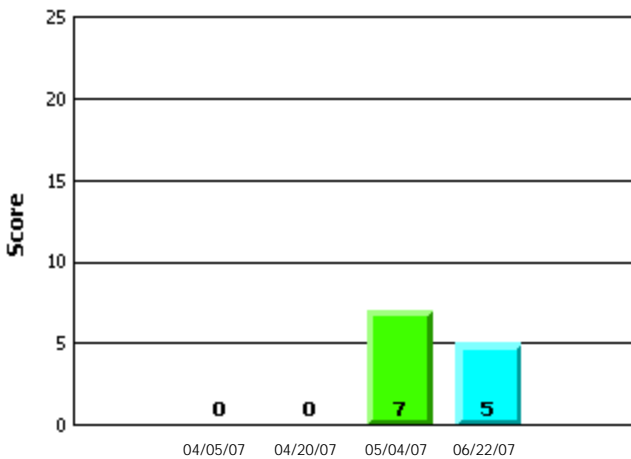
Visual Motor Speed Composite



Reaction Time Composite



Impulse Control Composite



Symptom Score

