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Concussion Management in Children and Adolescents

Amanda Pinnock

University of North Dakota

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Abstract

Concussion is a controversial topic right now in the world of sports and emergency medicine. Concussions are a common injury in children and adolescents that are involved in sports. It is important for everyone involved with adolescents and sports know and understand the signs and symptoms of concussions in order to prevent further complications of concussions. The systems of grading concussions are no longer used, and concussion management has moved towards return to play guidelines. In this case report, a sixteen-year-old female presented to the clinic for a pre-sports physical examination prior to starting volleyball and track, however, she had sustained a concussion six weeks prior. In having a previous concussion, it is prudent to ensure that this patient has no current post-concussion symptoms. It is also important to evaluate her risk of second impact syndrome. Second impact syndrome does not need to be a severe second injury to the brain. The first injury is believed to have sensitized the brain, and the second injury is devastating. The literature review conducted has shown that the return to play guidelines for concussion and head injury patients are highly individualized. Every practitioner, including those in rural settings, should have an expanded knowledge base regarding concussions and how to manage them.

Concussion Management in Children and Adolescents

Background

A sixteen-year-old female presents to the clinic for a relatively common visit: a sports physical. Each state and school has a specific form used and is presented to the provider to complete, following a certain guideline. However, this certain female had sustained a concussion from a motor vehicle accident 6 weeks prior to the visit. There are strict guidelines that the clinician needs to follow to ensure a safe and successful transition back to activity.

The treatment and management of concussions has changed and varies per source, and even the definition of concussion seems to change slightly. "The CDC defines mild brain injury (MTBI), or concussion, as a complex pathophysiologic process affecting the brain, induced by traumatic biomechanical forces secondary to direct or indirect forces to the head" (Reddy & Collins, 2009, p. 10). Concussion is a subclass of mild brain injury (Harmon, et al, 2013). According to Meehan and Bachur (2009, p. 114), "Concussion results from a rotational acceleration or deceleration injury to the head that causes an alteration of mental status or various other symptoms such as headache or dizziness".

The purpose of this paper is to present important information regarding concussions, second impact syndrome, and concussion management. This paper aims at providing learning points to manage concussions with children and adolescents, and provides take-away learning points to use in practice to ensure decreased risks to adolescent athletes. What are the steps to clearing a child or adolescent to returning to activity and play after a concussion? What is the appropriate timeline? An in-depth literature review was completed to address the most up-to-date concussion management and return to play guidelines.

Case Report

Chief Complaint

Sports physical

History of Present Illness

A.S. is a sixteen year old female that states she needs a pre-sports physical examination to participate in volleyball and cross-country. She offers no current complaints or concerns.

Past Medical History

Information obtained from the patient, who is a reliable and accurate historian. Will be calling patient's mother and obtaining medical records, with her permission, to gather more information regarding recent hospitalization for concussion.

Allergies: Patient denies any medication, environmental, latex, or food allergies.

Medications

None

Previous hospitalizations and/or illnesses

Was admitted to hospital overnight for observation related to a concussion she sustained post motor vehicle accident, approximately in December 2013 (6 weeks prior to examination).

Surgical History

None.

Injuries/Disabilities

Concussion 6 weeks ago. Left ankle: stress fracture, August 2013.

Health Maintenance

Last dental and eye exam within 1-2 years.

Immunizations

Childhood immunization series up-to-date per patient. Influenza vaccination 2013.

Family History

Mother: Hypertension

Father: Alive and no known illness or disease

No siblings

Maternal grandmother: Alive and no known illness or disease

Maternal grandfather: Alive and no known illness or disease

Paternal grandmother: Alive and no known illness or disease

Paternal grandfather: Alive and no known illness or disease

Denies any known family history of cancer, heart disease, congenital heart defects, thyroid disease, or other health problems.

Personal/Social History

Patient is a high school student that lives at home with her parents. She participates in volleyball and cross-country track. She runs "a couple miles" approximately 5 days a week, more during cross-country season. She is not sexually active. She does not smoke tobacco or use any illicit drugs, nor does she use alcohol or chewing tobacco.

Current Health Habits: Patient sleeps 6-8 hours per night. Patient states she does not eat breakfast, eats lunch at school, and eats at restaurants or fast food approximately 4-5 times per week for supper. When she doesn't eat out, she eats processed, frozen foods, such as pizza, canned soup, and frozen meats such as chicken nuggets. Rarely consumes caffeinated beverages. Diet is high in fat, sugar, and sodium. Consumes 2-4 servings of calcium per day. Diet is not balanced.

Review of Systems

General Patient denies any weight gain or loss, fever, chills, or fatigue. Denies any body image problems or being unhappy with weight.

Skin/Hair/Nails Denies any rashes, mole changes, lesions, masses, ecchymosis, odor, pruritus, acne, or problems with hair loss. Denies any cracked or discolored nails. Wears sunscreen on her arms while outside.

Eyes: Denies any visual changes, floaters, or blurred vision.

Throat/Neck: Patient denies any pain to neck or throat. No changes to tone or pitch of voice.

Chest/Lungs: Denies any history of asthma, coughing, wheezing, or cyanosis.

Cardiac and Blood Vessels: Denies palpitations or chest pain.

Gastrointestinal: Denies any current heartburn, epigastric pain, constipation, diarrhea, or bloody/black stools.

Genitourinary: Denies any vaginal discharge, itching, or odor. Last approximate menstrual cycle was around January 5th, 2014. Cycles are irregular, occurring approximately every other month. Denies any urinary frequency, incontinence, or urgency.

Peripheral Vascular: Denies any edema to any extremities or having one extremity larger than the other. Patient denies any lumps or nodules in neck, groin, or axilla.

Musculoskeletal: Denies any joint swelling, pain, or extremity pain, including previous stress fracture to left ankle.

Endocrine: Denies polydipsia, polyuria, heat, or cold intolerance.

Neurologic: Patient denies any syncope, dizziness, headaches, changes to mental status or cognition, lightheadedness, numbness, tingling, or seizures. She has had no neurological problems since return to play post concussion.

Physical Exam:

General: A 16-year old Caucasian female who is cooperative and pleasant. She appears well groomed, no body odor, and maintains eye contact with communication.

Skin/Hair/Nails: Skin is warm, pink, and has no redness or dried skin. Nails are non-brittle, and pink in color. No clubbing noted, capillary refill time < 3 seconds. Hair is groomed and free of dandruff, no alopecia noted.

Head and neck: No lesions or scars noted. Head is normocephalic and symmetrical. No tenderness to head or scalp with palpation. Facial features and movement equal and symmetrical. Facial expressions symmetrical, such as smiling, frowning, wrinkling forehead, pursing lips and blowing air out of mouth, showing teeth, puffing out cheeks, and squeezing eyes shut; cranial nerve VII intact. TM joint moves freely without crepitus. Neck and trachea symmetrical, no lesions or masses palpated. No lymph node enlargement present upon palpation of occipital, postauricular, preauricular, retropharyngeal, submandibular, or submental lymph nodes bilaterally. Tracheal cartilage is symmetrical and non-tender upon palpation. Appropriate rise of hyoid bone with swallowing noted. Thyroid smooth and mobile without masses or lesions. No carotid bruits auscultated and no JVD present. Full ROM in neck present, painless, and smooth such as chin to chest and chin to shoulder (CN XI), and trapezius and sternocleidomastoid strength +5/5 bilaterally (CN XI).

Eyes: Eyes are symmetrical and without ptosis. Bilateral sclera are white, no hemorrhages or redness noted, and conjunctiva are pink no drainage. Bilateral pupils are round, equal, and reactive, 2 mm in size. Both eyebrows are present and symmetrical. Bilateral corneas assessed and non-bulging on lateral view. Eyelashes present and curve away from globes bilaterally. No drainage noted to either lacrimal duct. Bilateral globes firm and easily depressed; patient denies any pain with palpation. No increased ocular tension. Red reflex present bilaterally (CN II) and blood vessels visualized with ophthalmoscope exam. Optic discs appreciated bilaterally, pink in color and pale in center, no edema or hemorrhages noted.

Ears: No lesions or redness noted to bilateral ears. No pain, tenderness, or masses noted with palpation to bilateral mastoid bones, auricle, and tragus. Otoscope exam of bilateral ears showed pearly grey tympanic membranes, non-bulging, right TM cone of light at 5 o'clock, left TM cone of light at 7 o'clock, bilateral malleus observed.

Nose and sinuses: Nose symmetrical in appearance. Bilateral nasal patency observed. Nasal exam with speculum revealed an intact septum with no signs of deviation or signs of perforation. Mucus membranes are moist and pink in color, clear drainage noted. Inferior turbinate seen bilaterally, also pink and intact.

Mouth and throat: Lips intact, moist, and without lesions. No oral or buccal lesions noted upon inspection. Cranial nerve XII not tested. No buccal masses palpated, no loose teeth. No drainage from gums or tongue. Soft palate, uvula, and tonsils pink, moist, and intact. Uvula is midline. Uvula and soft palate rise with phonation appropriately (CN X). Gag reflex not elicited (CN IX, X). No redness, swelling, or foul odor of oropharynx. No drooling noted and swallows without complications or difficulty. Teeth intact, no dental carries noted.

Chest and lungs: Breathing is non-labored and rate regular, no retractions or accessory muscle use noted. Lung sounds clear and equal throughout, no adventitious lung sounds auscultated. Respiratory expansion equal bilaterally. A/P diameter 2:1.

Cardiac and blood vessels: Heart rate regular. Apical impulse observed and palpated at 5th intercostal space, left chest with patient supine and sitting at 90 degrees. S1 and S2 heard with no split. No S3, S4, murmurs, gallops, mitral snaps, ejection clicks, or friction rubs are auscultated. No ectopy noted.

Abdomen: The abdomen is symmetrical without distention. Bowel sounds present in all four quadrants. No pain upon palpation to abdomen.

Musculoskeletal: No curvature noted to spine in standing position or touching toes. Gait is coordinated. No ankle clonus. Patient able to "hop on one foot" without difficulty or pain.

Assessment:

1. Pre-sports examination
2. Concussion, resolved.
3. Exercise induced menstrual irregularities.

Plan:

1. Patient is cleared for sports play. Information regarding concussions, second impact syndrome, healthy diet and exercise routines, avoiding peer pressure, and safety (wearing seatbelts) discussed with patient.
2. I will obtain medical records from hospitalization for concussion for future reference. I will also speak to patient's mother regarding recent injuries, healthy diet with possible referral to dietician, and exercise routine.
3. Offered hormonal contraceptive for maintaining regular menstrual cycles – patient deferred at this time. She will return if she changes her mind.

Literature Review

An in depth literature review was conducted using Google Scholar, PubMed and CINAHL through the University of North Dakota's Harley French Library. Using the search terms 'adolescent concussion' yielded 1758 article results. There were 498 results using the search words 'sports concussion management'. This literature review was used to help formulate

an understanding of concussions, the symptoms, and proper return to play guidelines to ensure the safety of children and adolescents when attempting to return to sports or activity after sustaining a concussion.

As previously stated, concussions have had different definitions. Unfortunately, this could lead to participants, coaches, and parents not recognizing the symptoms of a concussion. The International Conference on Concussion in Sport convened for the first time in 2001, and most recently in 2008, to review concussion standard of care. According to Sabini and Reddy (2010),

The panel's most recent Consensus Statement published in 2008 defines concussions as:

...a complex pathophysiological process affecting the brain, induced by traumatic biomechanical forces. Several common features that incorporate clinical, pathologic, and biomechanical injury constructs that may be utilized in defining the nature of a concussive head injury include:

1. Concussion may be caused by a direct blow to the head, face, neck, or elsewhere on the body with an "impulsive" force transmitted to the head.
2. Concussion typically results in the rapid onset of short-lived impairment of neurologic function that resolves spontaneously.
3. Concussion may result in neuropathologic changes, but the acute clinical symptoms largely reflect a functional disturbance rather than a structural injury.
4. Concussion results in a graded set of clinical symptoms that may or may not involve loss of consciousness. Resolution of the clinical and cognitive symptoms typically follows a sequential course; however, it is important to

note that in a small percentage of cases, post-concussive symptoms may be prolonged.

5. No abnormality on standard structural neuroimaging studies is seen in concussion (p. 139-140).

The pathophysiology of concussion is complex, as it involves a cascade of events between neurotransmitters and electrolytes. As soon as one suffers from a concussion, there is a disruption of neuronal membranes. This results “in a massive efflux of potassium into the extracellular space. This results in the calcium-dependent release of excitatory amino acids, particularly glutamate, which stimulates further potassium efflux. As the concentration of extracellular potassium increases, it triggers neuronal depolarization, which is followed by neuronal suppression” (Meehan & Bachur, 2009, p. 115). This all leads to the sodium-potassium pumps working to restore homeostasis; however, because of all of these processes, a large amount of energy is expended, thus increasing glycolysis (Meehan & Bachur, 2009). A decrease in cerebral glucose metabolism can be seen within 24 hours, and persist up to 10 days in experimental models (Meehan & Bachur, 2009).

According to the National Athletic Trainers’ Association, “An estimated 3.8 million concussions occur each year due to sports and physical activity” (2014). “Studies on children and adolescents have suggested that 26% of closed head injuries in children occur during athletics, and this is likely to be an underestimate because many children with sports related concussions, (SRC’s) do not seek medical attention” (Meehan & Bachur, 2009, p. 115). Many children, adolescents, coaches, and parents do not recognize the symptoms of concussions. For example, in Washington, coaches and athletic trainers are provided education regarding concussions and symptoms; however, parents and athletes receive much less education, possibly

contributing to the under-reporting of concussions in that state (Chrisman, Schiff, Chung, Herring, & Rivara, in press). It is reasonable to assume that this is not the only state in which there is a lack of concussion knowledge by parents, athletes, and the general public. The risk of not having proper knowledge regarding concussions puts one at an increased risk of a potentially fatal outcome- second impact syndrome. "Second Impact Syndrome (SIS) consists of two events. Typically, it involves an athlete suffering post-concussive symptoms following a head injury. If, within several weeks, the athlete returns to play and sustains a second head injury, diffuse cerebral swelling, brain herniation, and death can occur. SIS can occur with any two events involving head trauma. While rare, it is devastating in that young, healthy patients may die within a few minutes" (Bey & Ostick, 2009, p. 6). Because of this fatal complication, Washington has passed the Zackery Lystedt law, which requires medical clearance before resumption of activity, in addition to educational requirements (Chrisman, Schiff, Chung, Herring, & Rivara, in press). Other states, such as Connecticut, Idaho, Massachusetts, New Jersey, New Mexico, New York, Oklahoma, Oregon, Rhode Island, Texas, and Virginia, have all passed similar legislation (Harmon, et al., 2013). Practitioners should all be aware of their state's legislation on concussion management and return to play guidelines.

Symptoms of a concussion can differ. They can be greatest at onset, or they may worsen minutes to hours following the injury (Kutcher, 2010). Furthermore, if the symptoms worsen after they had seemed to be improving, one should be alert to the possibility of an epidural hematoma or other brain injuries. "Epidural hematomas produce a typical lucid interval, during which the athlete improves symptomatically shortly after the injury and may even appear completely normal while complaining of only minimal symptoms. As the hematoma expands, intracranial pressure increases to the point of compromising brain function, and the lucid interval

comes to an end, producing a dramatic clinical worsening, most notably in the level of consciousness” (Kutcher, 2010, p. 119). Signs and symptoms of concussions are: headache with or without phonophobia and photophobia, decreased reaction time, balance and coordination impairment, changes in memory, judgment, and speech, changes in sleep patterns, and/or loss of consciousness (AAN, 2013). Other symptoms can include nausea, vomiting, excessive fatigue, dizziness, visual changes, mental “fogginess”, difficulty concentrating, irritability, nervousness, increased sadness, insomnia, and difficulty waking (Harmon, et al., 2013). Although symptoms are acute, “neuroimaging should be reserved for patients where there is suspicion of an intracerebral structural lesion” (Upshaw, Gosserand, Williams, & Edwards, 2012, p. 928). The British Journal of Sports Medicine states that the affected person should not be left alone for 24-48 hours, and should return promptly to an emergency room for admission and further evaluation if: headache worsens, inability to be awakened, repeated vomiting, seizures, weakness or numbness to extremities, balance incoordination, or slurred speech (SCAT 3, 2013). It is important for anyone participating in activities or sports to be aware of the signs and symptoms of concussion.

If a coach or athletic trainer is questioning whether or not an athlete or participate of any activity has a concussion, they should sit out until proper evaluation by a trained medical provider is performed. Even after evaluation, there is a step-wise approach to returning to activity/play. It is important to stress that return to play does not happen in minutes or hours, rather, it is a complex process based on symptoms and symptom management. Concussion grading is no longer recommended. Each concussion should be dealt with on an individual basis.

Symptom management is an important avenue in treating and monitoring concussions. Concussion symptoms usually resolve in 7-10 days, however, the symptoms can linger for

weeks, months, or even years (Harmon, et al., 2013). A.S., the 16-year-old female from the case report, had headaches for 2 weeks post-concussion. She was admitted to the hospital overnight for observation, which is advised if a patient needs to be frequently monitored neurologically for changing symptoms. For headaches, sleep disturbances, nausea, neck pain, and other symptoms that generally accompany a concussion, one must be careful which medications are chosen. "In the acute setting (0-10 hrs post onset of injury), drugs that could alter mental status, such as benzodiazepines, should be avoided (level evidence C)" (Harmon et al., 2013, p. 22). After the acute phase, medications can be considered for symptom relief. One should avoid medications that alter cognition and affect the central nervous system (CNS), as it impairs the provider's ability to assess injury and cognitive impairment. In general, non-steroidal anti-inflammatory medications (NAIDS) and aspirin are not recommended, as they pose an increased risk of bleeding. Acetaminophen is preferred because of it provides pain relief without altering the CNS (Harmon, et al., 2013). If headaches continue after 3-4 days, abortive medications should be tailored to the headache type. In addition, headaches that occur as a part of post-concussion syndrome need a multidisciplinary approach (Harmon, et al., 2013).

Post-concussion syndrome (PCS) is a sustained set of symptoms (greater than 6 weeks in duration) related to the initial concussion. Headache, dizziness, cognitive impairment, and psychological symptoms are the most common complaints of PCS (Upshaw, Gosserand, Williams, & Edwards, 2012). The severity of the concussion does not determine whether or not one will develop PCS. Neuropsychological testing is useful in patients with cognitive or psychological complaints, which proves that computerized neuropsychological testing may serve to be useful pre-season evaluations and examinations (Upshaw, Gosserand, Williams, & Edwards, 2012). There is also persistent PCS (PPCS), which is long-term sequela of repeated

concussions. This may also include Parkinsonism and dementia. Those that suffer with PPCS are often more debilitated than they were immediately post-concussion, and often have more emotional symptoms and side effects (Upshaw, Gosserand, Williams, & Edwards, 2012). Treatments for this set of symptoms include antiepileptic drugs and/or tricyclic antidepressants for the headache, as well as selective serotonin reuptake inhibitors for post concussive depression (Upshaw, Gosserand, Williams, & Edwards, 2012).

Symptoms of the concussion, such as headache, sleep disruption, and depression could be from the concussion directly, or they could be symptoms of a pre-existing condition (Upshaw, Gosserand, Williams, & Edwards, 2012). "Athletes at high risk of concussions (those in collision or contact sports) should undergo baseline examinations before the competitive season. Baseline examinations should be completed annually for adolescent athletes, those with recent concussions and, when feasible, all athletes" (NATA, 2014). These baseline examinations should include a history, physical and neurologic evaluations, measure of motor control and neurocognitive functions (NATA, 2014). According to Guskiewicz, balance should be assessed at baseline, as "The objective measures from balance testing can provide clinicians with an additional piece of the concussion puzzle, remove some of the guesswork in uncovering less obvious symptoms, and assist in determining readiness to return safely to participation" (2011, p. 90).

Return to play after a concussion is gradual, progressive, and highly individualized. The individual should be free of concussion symptoms at rest as well as during and after exertion before returning to full participation. All baseline assessments should match current assessments (i.e. balance) if available (Upshaw, Gosserand, Williams, & Edwards, 2012). This progression may take days to weeks, even months, depending upon the individual's response to the increase

in activity. There is no guideline on returning to school. If the affected individual develops increased symptoms with cognitive stress, they may “require academic accommodations such as a reduced workload, extended test-taking time, days off, or a shortened school day (Harmon et al., 2013, p. 23).

Graduated Return to Play Protocol

Rehabilitation stage	Objective of stage
No activity	Recovery
Light aerobic activity	Increased heart rate
Sport specific exercise	Add movement
Non-contact training drills	Exercise, coordination and cognitive load
Full contact practice	Restore athlete’s confidence; coaching staff assess functional skills
Return to play	

Harmon et al., 2013

Because A.S. was already asymptomatic, she was cleared to participate in sports after much education was provided regarding concussions, second impact syndrome, and the need for further evaluation if a second concussion occurs.

Learning Points

Concussions are a common complaint in primary care and emergency departments. It is very important to understand concussions, the symptoms, treatment goals, and return to play guidelines when dealing with a concussed patient. Providers should maintain open communication with the patient, coaches, parents, and others involved in the patient’s care to

establish the best possible care. The most important things to remember when treating a concussion:

- Symptoms of concussion include headache with or without phonophobia and photophobia, decreased reaction time, balance and coordination impairment, changes in memory, judgment, and speech, changes in sleep patterns, and/or loss of consciousness (AAN, 2013). Other symptoms can include nausea, vomiting, excessive fatigue, dizziness, visual changes, mental “fogginess”, difficulty concentrating, irritability, nervousness, increased sadness, insomnia, and difficulty wakening (Harmon et al., 2013).
- Symptoms of a concussion can differ. They can be greatest at onset, or they may worsen minutes to hours following the injury (Kutcher, 2010). Furthermore, if the symptoms worsen after they had seemed to be improving, one should be alert to the possibility of an epidural hematoma or other brain injuries
- NSAIDS, aspirin, and any other medication that can alter the CNS should be avoided in the treatment of concussions.
- Treatment of concussions is individualized and concussions are no longer graded.
- Return to play (RTP) is gradual and highly individualized, with the goals being: recover, increase heart rate, add movement, exercise, coordination, and cognitive load, and restore confidence while assessing functional skills – all without having relapse of symptoms.
- RTP was established to decrease the incidence of second impact syndrome, a potentially fatal brain swelling after suffering a second brain injury close after the first.

References

- American Academy of Neurology (2013). AAN issues updated sports concussion guideline: Athletes with suspected concussion should be removed from play. Retrieved from <https://www.aan.com/PressRoom/Home/PressRelease/1164>
- British Journal of Sports Medicine. (2013). SCAT3, 47(259), 259-262. Retrieved from <http://bjsm.bmj.com/content/47/5/259.full.pdf+html>
- Bey, T., & Ostick, B. (2009). Second impact syndrome. *Western Journal of Emergency Medicine*, 10(1), 6-10. Received from <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2672291/>
- Chrisman, S., Schiff, M., Chung, S., Herring, S., & Rivara, F. (in press). Implementation of concussion legislation and extent of concussion education for athletes, parents, and coaches in Washington state. *The American Journal of Sports Medicine*. doi: 10.1177/0363546513519073
- Guskiewicz, K. M. (2011). Balance assessment in the management of sport-related concussion. *Clinics in Sports Medicine*, 30(1), 89-102. doi: 10.1016/j.csm.2010.09.004
- Harmon, K.G., Drezner, J.A., Gammons, M., Guskiewicz, K. M., Halstead, M., Herring, S.A., Kutcher, J.S., Pana, A., & Roberts, O. (2013). American medical society for sports medicine position statement: Concussion in sport. *British Journal of Sports Medicine*, 47(187), 15-26. doi: 10.1136/bjsports-2012-091941
- Kutcher, J. S. (2010). Management of the complicated sports concussion patient. *Sports Health: A Multidisciplinary Approach*, 2(3), 197-202. doi: 10.1177/1941738109357305
- Meehan, W., & Bachur, R. (2009). Sport-related concussion. *Pediatrics*, 123(1), 114-123. doi: 10.1542/peds.2008-0309

- National Athletic Trainers' Association. (2014). NATA issues new position statement on the management of sport concussion. NATA. Retrieved from <http://www.nata.org/News%20Release/nata-issues-new-position-statement-management-sport-concussion>
- Reddy, C. C., & Collins, M. (2009). Sports concussion: Management and predictors of outcome. *Current Sports Medicine Reports*, 8(1), 10-15. doi: 10.1249/JSR.0b013e31819539ca
- Sabini, R., & Reddy, C. (2010). Concussion management and treatment considerations in the adolescent population. *The Physician and Sportsmedicine*, 38(1), 139-146. doi: 10.3810/psm.2010.04.1771
- Upshaw, J., Gosserand, J., Williams, N., & Edwards, J. (2012). Sports-related concussions. *Pediatric Emergency Care* 28(9), 926-932. Retrieved from www.pec-online.com.

