NEUROANATOMY

The unique properties between the cerebral cortex and sports-related concussive injuries

Concussions are a large issue with a growing spotlight in sports; professionally, collegiately, and recreationally this is a problem commonly addressed. Maerlender et al's article "Concussion competencies: a training model for school-based concussion management"[1] chose to take a look at how concussive education can decrease risky behavior and overall cortical damage.

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Concussions are forms of mild traumatic brain injuries (mTBIs) from hits to the body that cause the brain to hit the inner skull and damage itself. The Centers for Disease Control and Prevention found that in 2014 2.87 million mTBI-related emergency department visits with 56,800 attributed deaths occured in the United States every year[2].

Maerlender et al's study looks to combat the dangers of concussions through early education and teaching students the risks early on. Adolescents that receive concussions while being in school are put in one of the worst possible environments; an expectation of mental and physical exertion, bright lights, noises everywhere. All of these scenarios help to exacerbate the symptoms of a concussion[2,3].

When the skull is accelerated at a rate that results in the collision between the brain and cranium, there is shearing of brain cells and blunt trauma of the internal brain structures[5]. The trauma caused by these mTBIs leads to symptoms such as noise/light sensitivity, confusion, amnesia, ringing in the ears, slurred speech, failure to track with eyes, and temporary loss of consciousness[6,7,8]. These symptoms arise from damage from unique cortical areas encoding for different senses. The article from Maerlander et al that is being focused on gives insight to how symptoms can be amplified in a school setting, further demonstrating the importance of educating students on concussion risk.

It's been observed that mild traumatic damage to the occipital lobe causes swelling and impairment in smooth pursuit and saccadic function[9]. Damage to the temporal lobe can cause problems with hearing; hypersensitivity, hyposensitivity, and some loss of function[10]. If damage is systemic enough, consciousness can be lost completely at the time of damage, and symptoms can

manifest themselves decades down the line[11]. Figure 1 provides an example and explanation of area specific damage found in concussive injuries.

All of these neurological symptoms can be annoying in the short term, but concussions have been shown to have long term-debilitating effects and even shorten expected lifespan[12]. Though the long-term systemic consequences of concussions are not fully known, and it is also not known how education of a young generation can lead to changes in this field of medicine.

Because of these risks, the focused research from Maerlander et al desired to educate adolescent student instructors about concussions in hopes to protect them. The study itself followed 102 participants staffed at schools primarily supporting grades 6-12 from 4 different schools. These staff members were given two trainings ranging between 2-3 hours each for a total of 4-5 hours. The hope was to provide school staff members with concussion management knowledge. This knowledge is given to help prevent concussion onset, diagnose possible concussions, and properly treat those with concussions. Participants were measured on two concussion competency tests produced by concussion experts; one test before and one test 5 months after training. Overall, there was a visible improvement on concussion competency scores among all tested groups, and 88% found the training to be satisfactory in the information given.

Maerlander et al's study was unique through not targeting coaches or students in sports, but other members of the school that these students will interact with. This concussion education allows for school staff to notice the signs of concussions and teach students about the science and dangers associated with concussions. Overall, only nine states have legislation requiring schools to have a protocol for managing concussed students as they return to academics; the hope is that through proving that useful information is retained more legislation may be put in place to help provide this education.

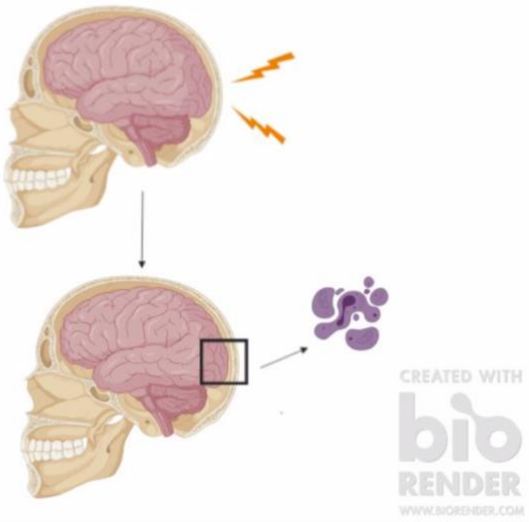

Figure 1. When a concussive blow occurs at the posterior portion of the skull, the occipital lobe will be most directly damaged. Possible hemorrhaging, inflammation, and cell death will occur in this area. This area specific damage is associated with symptoms such as temporary blindness, tunnel vision, and seeing stars after an impact occurs.

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