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Abstract

The number of concussions in sports and recreational activities are increasing on an annual basis. Students returning to school after a concussion face many challenges which can affect their learning and school reintegration process. Difficulties in learning, decreased academic performance, and classroom readjustment issues have been reported in earlier studies. The schools and teachers ability to understand basic concussion signs and symptoms, learning and classroom challenges as well as how to implement a return to learn plan play a vital role in the student's academic success.

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Abstract

The number of concussions in sports and recreational activities are increasing on an annual basis. Students returning to school after a concussion face many challenges which can affect their learning and school reintegration process. Difficulties in learning, decreased academic performance, and classroom readjustment issues have been reported in earlier studies. The schools and teachers ability to understand basic concussion signs and symptoms, learning and classroom challenges as well as how to implement a return to learn plan play a vital role in the student's academic success.

Introduction

Concussions are defined as a “complex pathophysiological process affecting the brain induced by biomechanical forces” (McCrory et al., 2013). A review of literature has supported the number of sport-related concussions keep rising every year (Graham, Rivara, Ford, & Spicer, 2014; Marar, McIlvain, Fields, & Comstock, 2012; Rosenthal, Foraker, Collins, & Comstock, 2014). In fact, Rosenthal et al. (2014) stated concussions in high school sports have doubled from 2005-2011. Football, soccer (girls more than boys), basketball (girls more than boys) and wrestling have more concussions per sport (Castile, Collins, McIlvain, & Comstock, 2012; Gessel, Fields, Collins, Dick, & Comstock, 2007; Marar et al., 2012; Rosenthal et al., 2014). More importantly, student-athletes are likely to not report previous head traumas which is of major concern (Delaney, Lamfookan, Bloom, Al-Kashmiri, & Correa, 2014; Llewlynn, Burdette, Joyner, & Buckley, 2014; McCrea, Hammeke, Olsen, Leo, & Guskiewicz, 2004; Meehan, Mannix, O'Brien, & Collins, 2013). The general reasons are not wanting to stop playing and the feeling of letting their team down.

For whatever reason, if the student is not reporting the concussion, then a general hypothesis could be formed that there are some students in the classroom with potential ongoing signs/symptoms of a concussion and the teacher could have no idea. The onset of learning challenges for the recovering post-concussion student could be an identifying marker for the teacher to recognize there are continuing problems with the student returning to school. Teachers who understand basic signs/symptoms, cognitive issues, learning and classroom difficulties as well as Post-Concussion Syndrome (PCS) are in a better position to help the student with their academic transition back into the

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classroom.

Post-Concussion Syndrome

The World Health Organization's (WHO) International Classification of Diseases (ICD-10) defines Post-Concussion Syndrome (PCS) as "a syndrome that occurs following head trauma (usually sufficiently severe to result in loss of consciousness) and includes a number of disparate symptoms such as headache, dizziness, fatigue, irritability, difficulty in concentration and performing mental tasks, impairment of memory, insomnia, and reduced tolerance to stress, emotional excitement, or alcohol (WHO, 2016)." PCS characteristically involves the lingering effects of the initial concussion that do not seem to be resolving within a few days to several weeks (McCrory et al., 2005). During this period, academic difficulties can occur as a result of increased cognitive activity which spawn post-concussion signs/symptoms. Cognitive rest is generally prescribed during the first few days to allow the brain to recover and resume normal functioning.

Cognitive Rest

Cognitive rest can be described as avoidance of cognitive activities that would stress the brain. Consensus statements, position statements, and proposed guidelines recommend the use of cognitive rest in the first few days following the initial concussion (Broglio et al., 2014; McCrory et al., 2013; Sady, Vaughan, & Gioia, 2011). Previous studies have shown positive effects when implementing cognitive rest for the student after a concussion (Brown et al., 2014; Majerske et al., 2008; Moser, Glatts, & Schatz, 2012). Arbogast et al. (2013) describes cognitive rest as the inclusion of no school, homework, reading, computers, video games, texting or any other form which can cause concussion signs and symptoms. Teachers need to be aware any of these activities can trigger reactions for the student which can delay concussion recovery. Although Gibson, Nigrovic, O'Brien and Meehan (2013) found no relationship between cognitive rest and prolonged concussion symptoms, the use of cognitive rest does necessitate the refraining of electronic media (Valovich-McLeod & Gioia, 2010). This is a critical factor since electronic media is a mainstream resource for society.

Concussion Sign/Symptoms

Approximately 80%-90% of concussions resolve within 7-10 days; however, the recovery time for children and adolescents could be longer (McCrory et al, 2005). Typical signs/symptoms of a concussion are divided into four areas: cognitive, physical, emotional, and sleep (Centers for Disease Control and Prevention, 2016; Nationwide Children's Hospital, 2012; Rocky Mountain Youth Sports Medicine Institute, 2011).

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Cognitive issues reflect the cerebral aspects surrounding brain activity such as concentration, memory, and even speech. For educators, these could be the most important as the student's ability to recall and focus on study material is impaired. Physical signs/symptoms refers to sensory areas of hearing, vision, balance, and can also include headache. The emotional state is the diverse range of personality reactions like irritability or sadness which can change in short periods of time. Sleep focuses on any deviations from normal sleep patterns that can contribute to daytime drowsiness and fatigue. While all of these areas are important, teachers making any connections between the student and how they act in the classroom can help determine any academic alterations. Table 1 outlines the most common concussion signs and symptoms.

Learning Difficulties

Learning difficulties and decreased academic performance has been demonstrated in existing research that shows 18 to 43 percent of post-concussion students had experienced a decline in school performance or readjustment issues back into the classroom (Arbogast et al., 2013; Baker et al., 2015; Darling et al., 2014; & Eisenberg, Meehan, & Mannix, 2014). In fact, students who performed higher levels of cognitive activity had a longer period of symptom recovery as well as a greater number of classes effected (Brown et al., 2014; Ransom et al., 2015). Subject content areas also pose learning challenges when the student returns to school. Ransom et al. (2015) reported that mathematics was the most difficult subject for students returning to the classroom after a concussion followed by reading, language arts, science, and social studies. Unpublished data by Bomgardner and Vermillion (2016) found that high school faculty had also reported learning difficulties in chemistry and foreign language. Since difficulty in concentration, focusing, remembering and feeling mentally foggy comprise the cognitive signs/symptoms, it is not too surprising these courses present the greatest challenges for students going back to the classroom after a concussion.

Classroom Difficulties

Classroom difficulties have been identified in the literature with students having trouble with headaches, fatigue, remembering, longer periods to think, concentrating, sensitivity to noise & light, as well as dizziness (Baker et al., 2015; Eisenberg et al., 2014). Lighting, noise level, daily course scheduling, classroom work, lecturing, student agenda or planners are some of the environment issues teachers should evaluate when the students returns to the classroom. Avoiding school-related "triggers" can help the student return to school without making the signs/symptoms worse. Common school-related triggers involve reading, technology usage in class (e.g. computers) and prolonged concentration (Nationwide Children's Hospital, 2012). More importantly,

Ransom et al. (2015) evaluated the academic effects of concussions on elementary, middle-school, and high school-school students. Students at the high school level reported greater deficiencies in academic skills (e.g. note taking, studying, and completing homework) than middle or elementary school students.

Return to Learn Plan

Returning the student to normal school activities can be challenging. The main concern is to not overwhelm the student too early with missing assignments, exams, or projects. Basically, returning a student to the classroom after a concussion involves a stair-step program that is consistent with a return-to-play model for physical activity. The emphasis is to progressively re-enter the student into their regular school schedule without any accommodations. Master, Gioia, Leddy, and Grady (2012) highlighted a simple graduated return-to-learn model that utilizes a progressive plan for the student as seen in Table 2. The focus is to gradually implement homework at home to determine a tolerance level before school work in class. Restrictions regarding classroom attendance, technology/media usage, homework, in-class work, and reading are evaluated before reintegrating the student back into the school setting. This allows the student time to complete school-related work without overloading them with too much make up work or new material. Nationwide Children's Hospital (2012) provides a return-to-school framework that delineates a structured progressive model on school attendance. As highlighted in Table 3, the concepts are similar to the graduated return-to-learn plan; however, the focus is on accommodations from no school, to half-day, full day attendance, and finally no restrictions. All accommodations and school days require no physical activity during the transition period back to school.

Conclusion

Teachers should be aware of the challenges post-concussion students face when returning to school. Cognitive impairments of difficulty concentrating, focusing, remembering and feeling mentally foggy hinder the learning process. In addition, awareness of other basic concussion signs and symptoms of physical, emotional, and sleep complications can aid the teacher in understanding classroom challenges. Previous literature has cited difficulties in learning, decreased academic performance and classroom readjustment issues with post-concussion students. Schools should have a return to learn plan in place to implement and provide resources for teachers to help their students readjust to the school environment. The success of the student's reintegration is strengthened by their teacher's awareness of their learning and

classroom difficulties.

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Table 1: Signs and symptoms of a concussion

Cognitive	Physical	Emotional	Sleep
feeling mentally foggy	headache	irritability	
drowsy			
difficulty concentrating	dizziness	sadness	sleeps
more or less than usual			
difficulty remembering	nausea/vomiting	nervousness	
trouble falling asleep			
difficulty focusing	sensitivity to light/noise	feeling more emotional	
fatigue			
easily confused	balance problems		
slowed speech	fatigue		
	Ringing in ears		
	Blurred/double vision		

Table 2. Graded Return-to-Learn

Stage	Activity Level	Exercise	Objective
1	No Activity	Complete cognitive rest – no school, reading, texting, video games, or computer work	Recovery
2	Gradual reintroduction to cognitive activity	Relax previous restriction on activities and add back for short periods of time (5-15 minutes)	Gradual controlled increase in sub-symptom threshold cognitive activities
3	Homework at home before school work at school	Homework in longer increments (20-30 minutes at a time)	Increase cognitive stamina by repetition of short periods of self-paced cognitive activity
4	School re-entry	Part of school after tolerating 1-2 cumulative hours of homework at home	Re-entry into school with accommodations to permit controlled sub-symptoms threshold increase in cognitive load
5	Gradual reintegration into school	Increase to full day of school	Accommodations decreased as cognitive stamina improves
6	Resumption of full cognitive workload	Introduce testing, catch-up with essential work	Full return to school; may commence return-to-play protocol

Master, Gioia, Leddy, & Grady (2012)

Table 3. Return to School Framework

Phase 1: No School

Symptom Severity: symptoms interfere with basic tasks and school responsibilities

Treatment: cognitive rest

Interventions: no school, no activities, (e.g. TV, texting, computer, video games, etc...)

Phase 2: Half-day attendance with accommodations

Symptom severity: symptoms decrease to manageable levels

Treatment: gradual re-introduction to school. Avoid tasks and “school-triggers” making signs/symptoms worse.

Interventions: prioritize class attendance, eliminate busy work, emphasize in-school learning, reduce homework

Phase 3: Full-day attendance with accommodations

Symptom severity: symptoms decrease to allow for more school work implementation

Treatment: gradually increase school work, time spent on school work, and difficulty of school work

Interventions: prioritize assignments, exams, and projects. Limit exams to one per day. No physical activity.

Phase 4: Full-day attendance without accommodations

Symptom severity: symptoms may be intermittent or resolved

Treatment: accommodations are removed when student can function fully without them

Interventions: develop plan to finish missed school work.

Phase 5: Full school and extracurricular participation

Symptom severity: No symptoms are present

Treatment: no accommodations are needed

Interventions: before returning to gym class, weights and/or sports, must complete the gradual return-to-play protocol

Nationwide Children’s Hospital (2012)