Concussion Management in Collegiate Student-Athletes: Return-To-Academics Recommendations

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Abstract: Concussions in collegiate athletics can affect student-athletes both on the field and in the classroom. As policies are made to outline return-to-play decisions and timelines, this article will make the case that return-to-academics should also be included and follow a step-wise protocol. Complete cognitive rest is a cornerstone of concussion recovery and slow reintroduction to academics should precede return-to-play. The college structure allows for student-athletes to begin small doses of cognitive activity after the recommended complete cognitive rest. It is recommended that return-to-academics involves a team approach to help the student-athlete navigate the responsibilities of course work while healing from a brain injury.

Key Words: cognitive rest, brain injury, recovery

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INTRODUCTION

Sport-related concussions are receiving much attention at all levels of athletics with an increased awareness that excessive impact to the brain begins a neurochemical cascade affecting overall brain function.[1–3] Much of the focus has been on repeated concussions or return-to-play before complete recovery which can have catastrophic consequences.[4] Governing bodies at the high school and collegiate levels are recommending or requiring a concussion management protocol, but what is included in this protocol is often dependent on the individual program or institution. Research has focused on the structural and functional consequences of concussive injuries with evidence that cognitive and/or physical stress/load may exacerbate symptoms and delay recovery.[5,6] Evidence-based research has focused on the importance of cognitive rest in the recovery process from concussions and made recommendations for youth as they return to the classroom.[7,8]

At the collegiate level, ages 17 to 23 years, the educational experience looks very different than it does in elementary, middle, and high school levels. Students spend less time in a classroom setting, often have more breaks throughout their day, and require more out of class work. While student-athletes have a rigorous schedule with classes, conditioning, practice, competition schedules, etc., there are opportunities to set up a return-to-academics plan that does not excessively impact their academic performance and may promote a faster recovery process. Most policies around concussion management have focused on return-to-play, and return to academics tends to follow a case-by-case need-based plan.[7–9] The goals of concussion management policies are to protect student-athletes from multiple injuries and life-long consequences; however, the role of cognitive stress and impact on academics in the life of a student-athlete is often overlooked.

The goal of this article is to highlight the impact of concussions on cognitive function of student-athletes and outline a recommendation for collegiate institutions to include return-to-academics protocol in their concussion management policies. The inclusion of return-to-academics timelines as a part of the concussion management policy of institutions will insure that practical management is evidence-based, understood by all constituents that are part of a student-athletes education, and consistent, thus protecting student-athletes from unforeseen impacts on their academic performance. We will make the case that cognitive rest is important for recovery from a brain injury, allowing student-athletes to return-to-academics and return-to-play in a timely fashion without jeopardizing their health and well-being and/or academic careers. However, a policy allows all constituents of the institution that work with student-athletes to be clear what the basic expectations and recommendations are following a concussive injury so appropriate accommodations are understood and can quickly be put into place. Table 1 includes the various stages of concussion assessment, recommendations on return-to-academics and play, and which components of the student-athlete support team should be involved at each stage.

BASELINE TESTING: IMPORTANCE OF NEUROCOGNITIVE TESTING

The National Collegiate Athletic Association (NCAA) recommends in their best practices for concussion management plan that institutions should have baseline assessments for their student-athletes and that it should consist of a symptoms checklist, standardized cognitive balance and cognitive assessments (eg, SCAT3), and neuropsychological tests whether this is pen and pencil or computerized neurocognitive assessment.[10] The most

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TABLE 1. Concussion Management Plan

	Baseline: Athletes Baseline Tested Before Play	Injury: Sideline Testing by Sports Medicine Staff	24–48 h Postinjury	<10 d: Gradual Return: If at any Point Symptoms Reappear with Increased Cognitive or Physical Load → Return to Cognitive and Physical Rest	>10 d: Individualized Determination of Return to Class/Return-to-Play	Recovery
Assessments	Neurocognitive testing	SCAT3	Neurocognitive testing	Symptom checklist (daily)	May consider referral to medical practitioner expert in management of concussion	When assessments return to baseline levels and athlete is asymptomatic
	SCAT3		SCAT3	When asymptomatic Neurocognitive testing SCAT3		
Cognitive/academic	Full activity	Complete cognitive rest (no class, text, video, films, music, etc.)	Complete cognitive rest	Gradual return to cognitive load → return to class Increase reading time/class time Increase attention activities Increase distractions in environment	Long-term modifications may be needed to continue in college-level course; may consider referral to neuropsychologist for more extensive testing	Return to class Some modifications to make-up missed work may be needed
Physical/sport participation	Full activity	Complete physical rest	No physical activity (no practice, weights, exertion)	No physical activity (no practice, weights, exertion)	Moderate physical activity	Gradual return to physical exertion → return-to-play
					Do not continue sport until symptom free	Aerobic exercise Sport-specific exercise Noncontact training Contact training Return to normal play
People involved	Sports medicine team Concussion assessment team	Sports medicine team	Sports medicine team Concussion assessment team Academic support	Sports medicine team Concussion assessment team Academic support	Sports medicine team Neuropsychologist Academic support Disability services	Sports medicine team Academic support

If at any point an athlete is asymptomatic and returns to baseline levels on concussion assessments, the sports medicine team can start recovery protocol.

recent consensus statement on concussion in sport say, "At present, there is insufficient evidence to recommend the widespread routine use of baseline neuropsychological testing" (p. 91).[3] However, this statement advocates for neuropsychological/neurocognitive testing when feasible because it adds "clinical value and contributes significant information in concussion evaluation" (p. 91).[3] The panel did not specify that baseline neurocognitive testing should be mandatory, but they acknowledge, as do others, that it can assist in return-to-play and return-to-academic decisions.[11] However, the American Academy of Neurology in their recent position statement suggests that baseline testing allows for better interpretation of postconcussion scores, especially in populations where results from neurocognitive testing might be compromised (eg, previous concussion, diagnosis of learning disability/attention-deficit/hyperactivity disorder).[12]

Even in the absence of baseline testing, neurocognitive assessment still has a role in concussion management because most tests have norms to reference for return-to-play. Additionally, neurocognitive assessment should only be one tool used in making return-to-play and return-to-academic decisions in addition to assessing symptoms and other balance and cognitive assessments, such as SCAT3.[3]

Lovell[13] has suggested that neurocognitive assessment occurs within 72 hours following a concussion. Neurocognitive assessment at this time may provide supplemental benefits such that the results may provide added value in determining protracted recovery from concussions relative to using symptoms alone.[13–17] This information may be useful when determining the prescription of cognitive rest and subsequent academic accommodations. Neurocognitive assessments taken at this time could also be used to signify that the brain needs more time for rest if the results are significantly below baseline scores. This would indicate potential cognitive impairment that may be exacerbated with a return-to-academics and therefore additional cognitive rest may be warranted. A review of previous research suggests that neurocognitive assessments may be more sensitive to recovery than symptoms alone and warrants the use of neurocognitive assessments in concussion management.[14]

CONCUSSION PATHOPHYSIOLOGY

Immediately following and for some time after trauma to the brain, there are neurometabolic changes that occur in the brain that are likely to induce functional changes in the brain that may manifest itself by various signs and symptoms.[1,2] The direct link of neurometabolic changes to specific signs and symptoms, however, has yet to be determined. The trauma to the brain causes mechanical damage from the forces applied to the head that cause a chemical cascade in the brain, leading to ionic imbalances, energy depletion, synaptic dysfunction, and neuronal injury/loss.[1,2] Immediately after the concussion, there is a depolarization causing release of the neurotransmitter, glutamate, and an efflux of potassium and an influx of calcium. The sodium–potassium pump attempts to regain homeostasis; however, this pump requires ATP and results in an increase in glucose metabolism. In addition to the increased need for glucose, there is a decrease in cerebral blood flow that results in a brain energy crisis. Following the initial increase in glucose metabolism, which may last from 30 minutes to 4 hours, glucose metabolism decreases below baseline levels. The increase in calcium may impair mitochondrial oxidative metabolism and make the brain energy crisis worse. Additionally, the increase in calcium may facilitate cell death. This increase in calcium may last a couple of days while the brain energy mismatch may last 7 to 10 days.

Therefore, the prescription of physical and cognitive rest is to allow the brain to recover from the injury and the subsequent metabolic crisis that result. Both physical and cognitive activity may result in an increase in metabolic demands and may also induce or exacerbate symptoms.[18]

COMPLETE COGNITIVE REST

In the last 3 consensus statements, experts have not only advocated for complete cognitive rest following injury but have said it is a "cornerstone" of concussion management along with physical rest, yet the implementation of this recommendation at the collegiate level is not yet standard protocol.[3,19,20] Majerske et al[5] found that athletes engaging in high amounts of physical and cognitive activity (ie, school) performed worse on neurocognitive performance and symptom scores. This suggests that physical and cognitive rest, as recommended in recent consensus statements, are appropriate recommendations for concussion recovery at all levels.

Cognitive rest involves avoiding activities that involve mental exercise because they cause excessive strain on the neurometabolic processes in the brain. These activities include: working on a computer, tablet, phone, or any screen; listening to loud music; reading; texting; playing video/computer games.[21] Practically, for collegiate student-athletes, this would also include avoiding all team/sport-related activities, such as watching films, practice, traveling to competition, etc. Activities that require attention, working memory, new learning retention, processing speed and cognitive flexibility should be avoided immediately after concussion and reintroduced slowly to make sure concussive symptoms do not reemerge.[22] (Refer Table 1 for timeline.) Completely avoiding these activities while symptoms persist allows time for the brain to heal. A recent study found that 1 week of cognitive and physical rest resulted in most patients returning to or above baseline on the neurocognitive assessment.[7] Another study found that the more cognitive activity engaged in by patients following a concussion, the longer the recovery time, suggesting the importance of cognitive rest.[23] One advantage of the college schedule is that it is very conducive to adding in appropriate cognitive load in a step-wise fashion. Evidence-based practice suggests 24 to 48 hours of complete cognitive rest following a diagnosed concussion.[3] After this initial rest period, the student-athlete should be re-evaluated on symptom and neurocognitive assessments. Having this information can be helpful in possibly predicting prolonged recovery from concussion.[14–17] The sports medicine team can then use these combined results to determine

TABLE 2. Return-to-Academics Progression

Stage	Activity	Objective
No activity	Complete cognitive rest	Recovery
Gradual reintroduction of cognitive activity	Slowly add cognitive activities for short periods and gradually increase time	Gradual increase cognitive activity at subsymptom threshold levels; increase length of time that can be tolerated
Gradual reintegration into academics	Begin introduction of class attendance; slowly build up attendance to full days	Increase cognitive load at subsymptom threshold; decrease accommodations needed
Resumption of full cognitive workload	Catch up with essential work; no restrictions	Full return to academics; commence return-to-play protocol

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return-to-academics and return-to-play recommendations/timelines.

RETURN-TO-ACADEMICS

Most college students take 12 to 16 credits, or hours spent per week in class, a semester, or quarter. Additionally, students have to expect to study approximately 2 to 3 hours outside of class for every hour in class per week. This equals 36 to 64 hours spent per week on academic activities. Thus, for students who suffer a concussion, there are some options to progressively introduce cognitive load related to academics and assess symptoms. The college setting is one that cognitive load can be reintroduced by starting course readings in small increments outside of class (10- to 20-minute doses), notes are often online, returning to class may need to begin slowly, and testing should be delayed until return-to-academics protocol is complete. Students should work with academic advisors, course instructors, and team physicians to assess possible return as more activities are added to their load (Table 2). The key will be to educate the student-athlete and the academic staff about limiting their activity, providing accommodations, and gradually increasing the amount of time engaged in cognitive tasks as symptoms allow. Davis and Purcell[24] suggest "A stepwise approach of increasing cognitive activity, similar to the stepwise exertion protocol for return-to-play, will allow students to return to the academic setting without exacerbating their symptoms" (p. 100). Once the student-athlete begins experiencing symptoms related to concussion, they should terminate or step back activity and resume cognitive rest, similar to what is expected with physical activity in return-to-play protocols. Symptoms

TABLE 3. Potential Academic Implications Based on Signs and Symptoms of a Concussion

Signs/Symptoms	Potential academic Implications	Accommodations
Headache	Difficulty concentrating Often triggered by florescent lighting, loud noises, prolonged focusing	Focus for short periods in quiet and naturally lit environments
Dizzy; lightheaded	Vestibular difficulties, difficult standing or changing levels (sit-to-stand)	Allow transition time for engaged activities; allow student to put head down if symptoms worsen
Visual symptoms (light sensitivity, blurred or double vision)	Difficult concentrating on visual information (PowerPoint, videos, reading, computer, etc.)	Give materials presented in class to student so they can work on it in spurts; provide a note-taker
Noise sensitivity	Loud activities in class (ie, group activities)	Allow to move to quieter location with group or do in a smaller group
Concentration and memory problems	Difficult to gather and retain new information, recall previously learned material, take tests, focusing in class	Provide new material in different formats for student to learn in small spurts outside of class (notes, lecture materials); provide test and assignment accommodations (delayed, more time)
Sleep disturbances	Difficulty falling asleep, difficulty waking up	Allow student to attend a later section if it is the same material

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TABLE 4. Concussion Management Team and Roles of the Team

Professional	Roles
Student-athlete	Report symptoms of concussion at all stages of injury and recovery
	Follow cognitive/physical rest requirements
	Communicate with advisors and instructors and come up with a realistic return-to-academics plan
Team physician	Responsible for health care of student-athlete
	Design and implement appropriate baseline concussion testing program
	Determine if student-athlete has a concussion and development a treatment plan for student-athlete
	Make ultimate determination about return-to-play and return-to-academics
Sports medicine staff/athletic trainer	Perform preseason baseline assessments on student-athletes
	Assessment of possible concussions during practice and competitions
	Monitor symptoms and performance on assessments to determine recovery progress
	Lead graduated return-to-play protocol
Neuropsychologist	Perform neuropsychological assessments following concussions
	Make recommendations about treatment and return-to-academics
Academic support/disability services	Inform faculty about class absences when it is discovered a student-athlete has suffered a concussion
	Keep faculty informed about progress of student
	Educate faculty about implications of concussion on student
	Help student-athlete
Coach	Be supportive and understand the concussion management protocol
	Assist in the implementation of treatment recommendations to the student-athlete
Athletic director	Be supportive and understand the concussion management protocol
	Encourage education of athletics department about concussions and their consequences
Provost, chancellor, CEO	Be supportive and understand the concussion management protocol
	Encourage education of faculty and staff at institution about concussions and their consequences

will vary by individual and thus accommodations will also need to vary (refer Table 3 for examples).[8]

Eighty to ninety percent of individuals' symptoms have subsided within approximately 10 days of injury.[3] Thus, most students will be back to a regular academic load within a week to 10 days of injury. However, some accommodations to make up tests and assignments may be needed because of missing class for a week that puts the student behind in course work. Thus, it is important for students to be in contact with instructors and work on a modified plan. Encouraging students to work in small spurts will help them not fall too far behind in course work before returning to class. For the small percentage of students that have prolonged recovery, a modified plan may need to be designed in conjunction with disabilities services and instructors. This may include cognitive, vestibular, physical, and psychological therapies.[25] A recent review suggests that low levels of exercise might be helpful in the recovery of those who are slow to recover from concussions.[26]

In regards to return-to-academics, it might be helpful or necessary to consult with a neuropsychologist, especially in cases of prolonged recovery. Other people who might be involved in the new treatment plan, that includes cognitive rest and academics, may include: academic support staff, team physician, course instructors, and disabilities services.

CONCUSSION MANAGEMENT TEAM

As discussed previously, the NCAA requires all college athletic programs to have a concussion management protocol. In this plan, it should clearly delineate the roles that different professionals will play in returning a concussed student-athlete to play and academics. The resources available will vary between schools, but each institution will need to determine what is most feasible in their circumstance. It is also important that all people involved in the protocol agree on key components, such as the definition of concussion, the management of the concussion, and return-to-play guidelines.[11] We argue that return-to-academics guidelines should be included in this as well. See Table 4 for the professionals who may be involved and the role that they may play.

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