

# Importance of ‘Return-to-Learn’ in Pediatric and Adolescent Concussion

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The concept of “return-to-play” after concussion is familiar to pediatricians who routinely care for injured student-athletes. Premature return-to-play of a student-athlete who is still injured from a concussion may result in more severe and potentially long-lasting deficits.<sup>1</sup>

In contrast, “return-to-learn” plans for student-athletes have not received as much attention, perhaps because so much regarding concussion awareness comes from lay reports of professional athletes who play a sport for their livelihood, as compared with pediatric and adolescent-aged athletes for whom school is their primary “work.”



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## CME EDUCATIONAL OBJECTIVES

1. Prescribe physical and cognitive rest for pediatric and adolescent concussion.
2. Implement a gradual “return-to-learn” plan for student-athletes after concussion.
3. Communicate specific school-based accommodations to facilitate a gradual reintegration to full school activities.

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SIDEBAR 1.

**Concussion Care Plan**

- Prescription for cognitive rest
- Return-to-learn plan
- Return-to-play protocol

Source: Master CL, Gioia GA, Leddy JJ, Grady MF

Pediatric and adolescent concussions have many unique features requiring special attention from the pediatrician in terms of diagnosis and management. This article addresses the importance of properly timing school re-entry.

**CONCUSSION CARE PLAN  
Prescription for Physical and  
Cognitive Rest**

After the diagnosis of concussion is made in the pediatric or adolescent patient, the first step in any concussion management plan is the institution of both physical and cognitive rest (see Sidebar 1). The concept of physical rest is typically well-understood by patients. Concussed student-athletes may participate in normal activities of daily life that do not result in an increased heart rate or breaking a sweat; it is important that the activities do not trigger or worsen symptoms. The critical management point in these guidelines is to avoid diverting glucose from the brain during the period of reduced bioavailability in the acute post-injury phase. Although this concept may be difficult for active patients to accept, implementing these instructions is generally straightforward.

Cognitive rest, in contrast, can be a more difficult concept for physicians to communicate, and for patients and families to understand and implement. In its most extreme form, cognitive rest initially includes no school attendance, no home/school work, no reading, no video games, no texting, no computer time, and for some children in whom it triggers symptoms, no television. The goal is to keep cognitive activity below

Cognitive Activity Monitoring (CAM) Log							
Name _____				Parent/ Teacher: _____			
DATE							
TIME							
LOCATION (circle one)	Home	Home	Home	Home	Home	Home	Home
	School	School	School	School	School	School	School
COGNITIVE ACTIVITY:							
DURATION:							
SYMPTOM (PRE/POST)	Rate 0-10	Rate 0-10	Rate 0-10	Rate 0-10	Rate 0-10	Rate 0-10	Rate 0-10
HEADACHE	/ /	/ /	/ /	/ /	/ /	/ /	/ /
FATIGUE	/ /	/ /	/ /	/ /	/ /	/ /	/ /
CONCENTRATION PROBLEMS	/ /	/ /	/ /	/ /	/ /	/ /	/ /
IRRITABILITY	/ /	/ /	/ /	/ /	/ /	/ /	/ /
FOGGINESS	/ /	/ /	/ /	/ /	/ /	/ /	/ /
LIGHT/ NOISE SENSITIVITY	/ /	/ /	/ /	/ /	/ /	/ /	/ /
Other: _____	/ /	/ /	/ /	/ /	/ /	/ /	/ /
PRE-POST DIFFERENCE	_____	_____	_____	_____	_____	_____	_____

Figure 1. Example of a symptom monitoring tool.

the level that triggers symptoms, such as headache or fatigue, during the days following acute concussive injury. This is referred to as “subsypmtom threshold cognitive activity” and is the general guiding principle throughout recovery.

At this early stage it is important to provide patients and families with suggestions for activities that they can attempt that may not trigger symptoms. Feedback from injured patients indicates that activities such as drawing, playing with Legos or cars, and baking may be tolerated by acutely concussed patients for short periods of time. These activities allow guided self-pacing of the activity and do not require prolonged, sustained, cognitive attention, which is what the injured brain cannot muster acutely after injury.

For all pediatric and adolescent patients who sustain concussion, school is their primary work, and the idea of missing school for a concussion is often seen by patients and parents as a significant barrier to the implementation of cognitive rest as a plan. The importance of excusing a patient from school

for a concussion is also relatively new to some physicians who, in the past, would have allowed students to return to school immediately after sustaining “just a concussion” because of the misperception that mild traumatic brain injury (mTBI) is equivalent to mild downstream consequences and symptoms.<sup>2</sup> However, it is now clear that removal from the significant demands of school until symptoms improve is an important component of cognitive rest.<sup>3,4</sup>

Physician documentation that the patient should be excused from school for the cognitive rest period is essential. Additionally, provision of specific written instructions for the patient and family in the form of a concussion care plan, with a prescription for cognitive rest, is important to help the patient and family comply.

Although the limitations described above (eg, school, video games) should be observed, low-key social interactions that do not cause symptoms are permitted to prevent social isolation or depression and anxiety as the result of removal from normal daily routines. These in-

Image courtesy of Gerard A. Gioia, PhD. Reprinted with permission.

TABLE 1.

**Return-to-Learn Plan**

Stage	Activity	Objective
No activity	Complete cognitive rest — no school, no homework, no reading, no texting, no video games, no computer work.	Recovery
Gradual reintroduction of cognitive activity	Relax previous restrictions on activities and add back for short periods of time (5-15 minutes at a time).	Gradual controlled increase in subsymptom threshold cognitive activities.
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.
School re-entry	Part day of school after tolerating 1-2 cumulative hours of homework at home.	Re-entry into school with accommodations to permit controlled subsymptom threshold increase in cognitive load.
Gradual reintegration into school	Increase to full day of school.	Accommodations decrease as cognitive stamina improves.
Resumption of full cognitive workload	Introduce testing, catch up with essential work.	Full return to school; may commence Return-to-Play protocol (see Step 2 in Table 2).

Source: Master CL, Gioia GA, Leddy JJ, Grady MF

clude such activities as short conversations on the phone with friends, having a meal with grandparents, and other such activities that may be undertaken without exacerbation of symptoms (ie, subsymptom threshold activity). In general, patients should be instructed that if symptoms are worse with any particular activity, they should stop that activity.

As with other clinical entities, the physician's greatest challenge in managing a patient through the early stages of concussion is to individualize each concussion management plan to the patient at hand. The difficulty in managing concussion is that there is currently no way to accurately predict prospectively from the beginning what each individual's recovery trajectory will be.

As such, starting with strict cognitive rest and then relaxing the restrictions as the patient's symptoms allow has, in our experience, provided an effective means of initiating the acute management of concussion for all patients. Monitoring the patient's response to the prescribed

activities provides a useful guide for recommended activities as well as a means to track recovery progress. We recommend using a symptom monitoring tool to guide this process (See Figure 1). In most acute concussions, patients will note a decrease in headaches and other symptomatology in response to cognitive rest over the ensuing days. The goal is to achieve periods of time where they are symptom-free and headache-free, ideally for up to 24 hours, before beginning to add cognitive activity back into their routines.

### **Return-to-Learn Plan** **Gradual Reintroduction of Cognitive Activity**

Just as there is increasing evidence of the importance of physical as well as cognitive rest in the acute management of concussion, there is also increasing evidence that children and adolescents benefit from a controlled, gradual return-to-learn approach, rather than an attempt to return to a full school load immedi-

ately after cognitive rest has resulted in symptom abatement. In our experience, pediatric and adolescent patients clearly have worse symptoms with an abrupt attempt to return to full activity, but have improved symptoms when the return-to-learn process is supervised in a controlled fashion with specific directions for increase.<sup>5</sup> If left to their own devices, patients often pursue a too-rapid return-to-learn with a steep ramp-up of return to cognitive activity, which often results in the exacerbation of concussion symptoms that had previously been improving. This essentially causes the patient to prolong their ultimate recovery and return to full activities.

It is important, therefore, for physicians who care for pediatric and adolescent patients with concussion to teach the parent and patient the subsymptom threshold activity concept and to provide a return-to-learn plan for families and schools in order to update all of those who care for and work with injured student-athletes recovering from

## SIDEBAR 2.

### School Accommodations Upon Re-Entry

- Breaks as needed in a quiet place
- Preprinted class notes
- Additional time for assignments
- Excuse nonessential work, no double workload of make-up work and new work
- Additional help and tutoring as needed
- No testing until tolerating a full day of school, then untimed testing

Source: Adapted from [www.cdc.gov/concussion/headsup/pdf/ACE\\_care\\_plan\\_school\\_version\\_a.pdf](http://www.cdc.gov/concussion/headsup/pdf/ACE_care_plan_school_version_a.pdf)<sup>8</sup>

concussion (see Table 1). The explosion in knowledge and expertise surrounding concussion management in the past decade has been tremendous; families and schools need to be kept up-to-date on recent developments.

Once patients at physical and cognitive rest begin to feel that they have returned to their pre-injury baseline, the most common problem in recovery is a false sense that they are able to return immediately to full activities.

There will be some children who are able to ramp up their cognitive activity quickly over a few days; this is often seen with a first concussion. In contrast, there are many children who require a slow, controlled ramp-up in cognitive activity to prevent recrudescence of severe concussion symptomatology, even with their first concussion. Using a standardized symptom monitoring tool (see Figure 1) can help to determine the tolerable rate of increase in cognitive activity.

Once patients feel well at rest, restrictions on cognitive activity can be relaxed, allowing patients to resume the activities that had been restricted immediately after injury for short periods of time. Some children will only tolerate 15 to 20 minutes of cognitive activity initially, whereas some may tolerate longer periods without symptoms.

At this point, it is important for the patient's family to know that children should undertake cognitive activity for only the portion of the time that it took to produce mild symptoms (ie, sub-symptom threshold for cognitive activity). For example, if reading for a half an hour produced head pressure or a mild headache, the child should read for only 20 minutes on the next attempt, and then take a cognitive break, before symptoms are exacerbated. This can be repeated several times in a day as tolerated.

The following day, patients can attempt an increase in the duration of cognitive activity, but only up to the point at which they become symptomatic. They should stop the activity when mild symptoms develop and before severe symptoms develop, in order to take a cognitive break. When patients feel better after that break, they can resume cognitive activity once more, either by participating in the same or another activity.

The process of subsymptom threshold cognitive activity is then repeated. It is essential to educate patients about symptom-recognition at this stage; often the mild symptom is not a full-blown headache, but patients will commonly describe a dull global pressure in their head that precedes a more severe headache. The use of a symptom monitoring tool (see Figure 1) can facilitate the pediatrician's teaching of symptom recognition. If possible, patients should stop their cognitive activity at the point of developing the sensation of dull pressure and prior to developing a headache. They may repeat this pattern multiple times a day as tolerated and over the course of many days. Eventually, patients should be able to increase their stamina for cognitive work at home up to 45 minutes to 1 hour at a time without a break.

#### **Homework at Home Prior to Schoolwork at School**

Another essential component of this controlled ramp-up of cognitive activity

involves the concept of a trial of cognitive activity prior to returning to school (ie, attempting homework at home before attempting school work at school). An entire day of school can be likened to a marathon for the brain — it requires long periods of sustained cognitive attention. Many post-concussion student-athletes are unable to resume that level of sustained cognitive activity after injury and cognitive rest; they require a period of time to gradually return to the level of cognitive stamina required for a full day of school.

A student who tolerates a trial of homework at home, where they can carefully work up to a controlled, self-paced cumulative 2 hours of homework in 30- to 45-minute increments, is likely to succeed with a trial of a part-day school schedule. Some students are able to return more quickly over a few days with cognitive activity, based on their lack of symptoms, and can manage 3 to 4 hours of homework at home. In our experience, this correlates with a successful attempt to return to a full day of school directly.

The benefit of a trial of homework at home prior to school work at school, is that the home setting allows for more careful control of a self-paced increase in cognitive activity with breaks as needed compared with school work at school, which occurs at a brisk, unrelenting school pace. Most students, despite exacerbation of symptoms in school, often feel compelled to work at the school pace rather than the controlled self-pace needed to return to full school activity after a concussion. This makes the home setting the ideal place to initiate the return to cognitive activity.

#### **School Re-Entry**

Once students have completed a controlled ramp-up of homework at home, and are ready for a trial of school work at school, it is important that school nurses, teachers, administrators, and

guidance counselors be made aware of the accommodations necessary to support the student's re-entry to school after suffering a concussion<sup>6-8</sup> (see Sidebar 2)

Letters detailing such accommodations are an essential link in the communication between the pediatrician and the school regarding the student-athlete's injury and stage of recovery. Common accommodations that are needed include permission to take cognitive breaks in between classes in a supervised quiet location as needed, usually every two periods or so for traditional 1-hour classes. It is important that any nonessential school work be excused because concussions are a brain injury. The recovering concussion patient will not be able to perform a double workload of new work and make-up work; depending on the amount of school missed, the volume of all the catch-up work and new work may be physically impossible for the student to complete.

Additional time will be needed for all essential assignments and projects. Tutoring and extra help may also be necessary. Preprinted class notes may be an important supplement to taking notes in class. Extra time will also need to be provided for preparation for any tests that should not be administered until the patient is tolerating full-day school and full normal workloads. Once they have attained this level of recovery, they may only take tests at a rate of one per day; those tests should be untimed and broken up over multiple days if needed.

### **Gradual Reintegration and Full Return to School**

Sometimes a letter from the physician is sufficient for school accommodations; in other circumstances, however, a formal 504 Plan for accommodations is necessary. For children with an existing 504 plan or individualized education plan (IEP), the

TABLE 2.

**Return-to-Play Protocol**

Stage	Activity	Objective
No activity	Complete physical rest.	Recovery
Light aerobic exercise	Walking, swimming, aerobic exercise up to 70% of maximum predicted heart rate; no resistance training.	Increase heart rate.
Sport-specific exercise	Sport-specific exercise such as skating, running drills; no head impacts.	Add movement.
Noncontact training drills	Progress to complex drills; add resistance training.	Exercise, coordination, add cognitive load.
Full contact practice	Normal practice after cleared by medical personnel.	Restore confidence and timing, allow assessment of functional skills.
Return to play	Normal game play.	Full return to play.

Source: Adapted from Consensus Statement on Concussion in Sport 3<sup>rd</sup> International Conference on Concussion in Sport held in Zurich, November 2008.<sup>1</sup>

accommodations may be incorporated into those pre-existing plans. Most children with a typical concussion recovery pattern will steadily increase their cognitive stamina during the controlled ramp-up, gradually shedding their need for accommodations over the subsequent weeks. Students who have these accommodations in place with supportive school settings do well. Patients often experience considerable anxiety about missing school as the result of cognitive rest for concussion. Once that pressure is relieved, students can focus on recovery, which often results in a considerable improvement in symptoms.

When students continue to feel under pressure to return to school prematurely after injury and undertake a workload beyond their cognitive capacity, there is often both worsened anxiety as well as a recrudescence of severe concussion symptomatology. This exacerbation often prolongs symptoms and delays re-

covery.

### **Return-to-Play**

Once a student-athlete has achieved return to a full day of school without symptoms while tolerating a normal course load, including testing, the formal return-to-play protocol may begin (see Table 2). Prior to this step, light activity as tolerated is permitted as long as symptoms are not triggered. Overlooking the return-to-learn steps with the primary focus on return-to-play may actually delay eventual return to full play while wreaking havoc on the re-entry into school.

For many student-athletes, careful management of the return-to-learn steps results in smooth school re-entry with subsequent rapid progression through the full return-to-play protocol. This attention to return-to-learn actually results in the fastest return-to-play possible for the pediatric and adolescent athlete. The return-to-play has been addressed in depth and readers are referred

to the 2008 Zurich consensus statement for details.<sup>1</sup>

### TYPICAL VS. ATYPICAL RECOVERY

The concussion care plan described here is intended for the patient with a typical concussion recovery pattern, in which symptoms abate in response to cognitive and physical rest, and the student-athlete is able to gradually increase cognitive activity via a controlled ramp-up over the course of 1 month.

In the small proportion of patients whose symptoms do not resolve with cognitive and physical rest, or who, after 1 month, still experience symptoms associated with the inability to re-enter school, there are many other considerations. Managing the school-related issues for these patients may require more significant modifications to the school work schedule. This might include a period of homebound tutoring while continuing to rehabilitate from their concussion before attempting to re-enter school full-time, usually with formal accommodations such as a 504 plan or an IEP.

These patients require much advocacy on the part of their parents and their pediatrician, along with the help of

organizations such as the Brain Injury Association of America, which has state affiliates dedicated to advocating for patients suffering from brain injury across the country. Please see the companion article (by Vidal and colleagues) in this issue regarding rehabilitation strategies in prolonged concussion for further discussion of the medical management of these patients.

### CONCLUSION

Physicians should be familiar with return-to-play protocols based upon the 2008 Zurich Consensus Statement on Concussion, which represents a controlled, step-wise return-to-sport. In pediatric and adolescent student-athletes, a corresponding return-to-learn protocol is an essential prerequisite for return-to-play and is an important component of recovery and return to normal activity. Specific instructions in the form of a prescription for cognitive and physical rest followed by a gradual return-to-learn plan are essential to help student-athletes recover from concussion and make steady progress toward full re-entry into school and return-to-play and other activities. ■

### REFERENCES

1. McCrory P, Meeuwisse W, Johnston K, et al. Consensus Statement on Concussion in Sport 3rd International Conference on Concussion in Sport held in Zurich, November 2008. *Clin J Sport Med.* 2009;19(3):185-200.
2. DeMatteo CA, Hanna SE, Mahoney WJ, et al. "My Child Doesn't Have a Brain Injury, He only Has a Concussion." *Pediatrics.* 2010;125:327-338.
3. Moser RS, Glatts C, Schatz P. Efficacy of immediate and delayed cognitive and physical rest for treatment of sports-related concussion. *J Pediatr.* 2012; May 22. [Epub ahead of print]
4. Halstead ME, Walter KD; Council on Sports Medicine and Fitness. American Academy of Pediatrics. Clinical report—sport-related concussion in children and adolescents. *Pediatrics.* 2010;126(3):597-615.
5. Gioia G, Vaughan C, Reesman J, et al. Characterizing post-concussion exertional effects in the child and adolescent. *J Int Neuropsychol Soc.* 2010;16(S1):178.
6. McGrath N. Supporting the student-athlete's return to the classroom after a sport-related concussion. *J Athl Train.* 2010;45(5):492-498.
7. Sady MD, Vaughan CG, Gioia GA. School and the concussed youth: recommendations for concussion education and management. *Phys Med Rehabil Clin N Am.* 2011;22(4):701-719.
8. Gioia GA, Collins MW. Acute Concussion Evaluation (ACE) Care Plan: School Version. In: "Heads Up: Brain Injury in Your Practice" tool kit developed by the Centers for Disease Control and Prevention (CDC). 2006. Available at: [www.cdc.gov/concussion/headsup/pdf/ACE\\_care\\_plan\\_school\\_version\\_a.pdf](http://www.cdc.gov/concussion/headsup/pdf/ACE_care_plan_school_version_a.pdf). Accessed Aug 2, 2012.