

Understanding the Needs of Students with a Concussive Brain Injury



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Objectives

1. Understand the mechanics of a concussive brain injury.
2. Identify the signs and symptoms associated with a concussion.
3. Recognize how concussion symptoms can impact student learning.
4. Understand best practices in concussion management.



A Student is Identified with a Mild TBI/ Concussion

What Do You Do?



Scenario 1 (elementary school playground)

A student is playing on the playground at recess. He/ She falls from the playground equipment and lands on his/her shoulder and head. He does not move for about 5 seconds, and is slow to get up. He/ she comes over to you initially a bit groggy and appears stunned. After a few minutes, he / she seems to look okay, and wants to go back to play. His parent wonders if he/she should go to school tomorrow.

What to do about School?



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Return to School Kid's Major "Job"



- New Learning/ Acquiring Knowledge
 - Academic
 - Social
- Practicing incompletely learned knowledge
- Mental/ Cognitive exertion is essential to new learning/ practice



Questions for Schools to Prepare For

1. When a student is identified with a concussion, what is your response? High school, middle school, elementary school
2. Who is the Concussion Management team? Is there one? Who will do what? What are their roles?
 - a. Parent contact?
 - b. Contact with the teaching team?
 - c. Method to disseminate student needs and accommodations/ strategies
3. Is there a teacher in-service program about concussion, its academic effects and the supports?



Questions to Prepare For

1. When does a student stay home, when does a student return to school (criteria for partial vs full day)?
2. With what information do you base your decisions?
3. Where/ how / who will you provide key supports and accommodations for the student?
4. Once in school, how and who monitors recovery across the day/ week, and adapts the accommodations as needed?



Goals of Proper School Return

- Prepared System: trained medical and school providers
- Initial medical evaluation of student & communication of symptom profile to school
- Coordination / communication between Family, Medical Provider, School, Athletics
- School team available to translate into necessary adjustments & accommodations
- Regular school monitoring of symptom progress & communication to medical provider and family



What is a concussion?

- A bump, blow or jolt to the head or body that causes the brain to move rapidly back & forth
- Causes stretching of brain, causing chemical changes, and cell damage
- Causes change in how brain works (signs & symptoms)
- Once these changes occur, brain is more vulnerable to further injury and sensitive to increased stress



Concussion = Traumatic Brain Injury



Effects of Concussive Forces on the Brain

- Typically, the “software” of the brain is affected
 - Neurometabolic/ neurochemical processes
 - Physiological
- Not the “hardware”
 - Structure



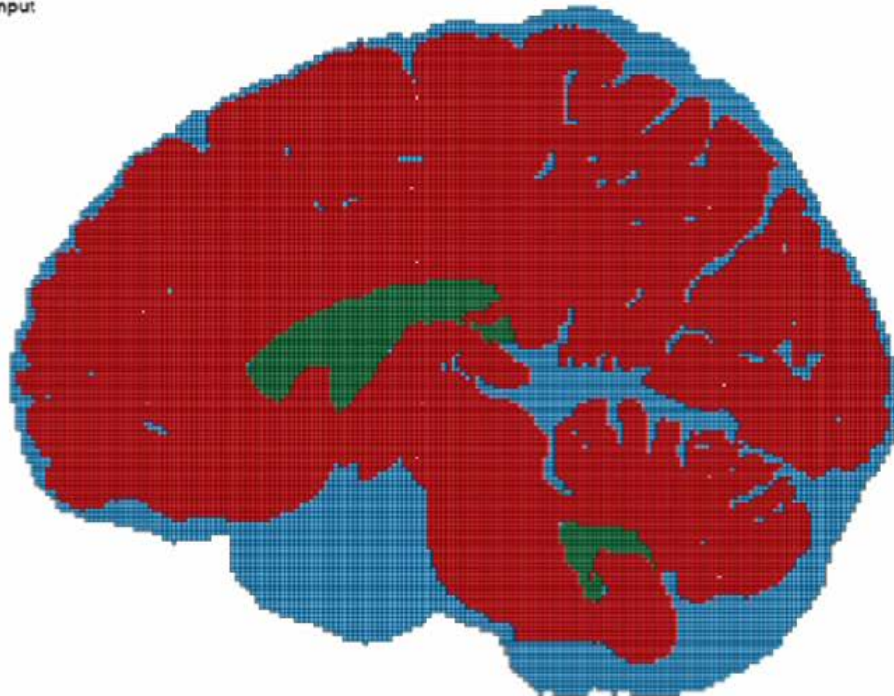
PLAY BRAIN SLIDE

This is a slide showing the brain's movement when a force is applied. You can see it stretching and straining as it twists inside the skull. The stretching of cells results in an abnormal movement of chemicals in and out of the cells and an impairment of the axon's electrical transmission.

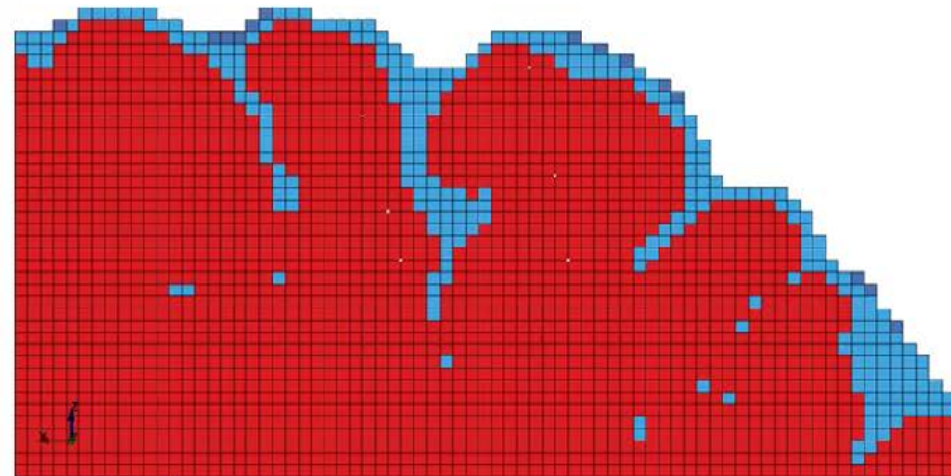


Brain Motion...

user input



LS-DYNA user input
Time = 0

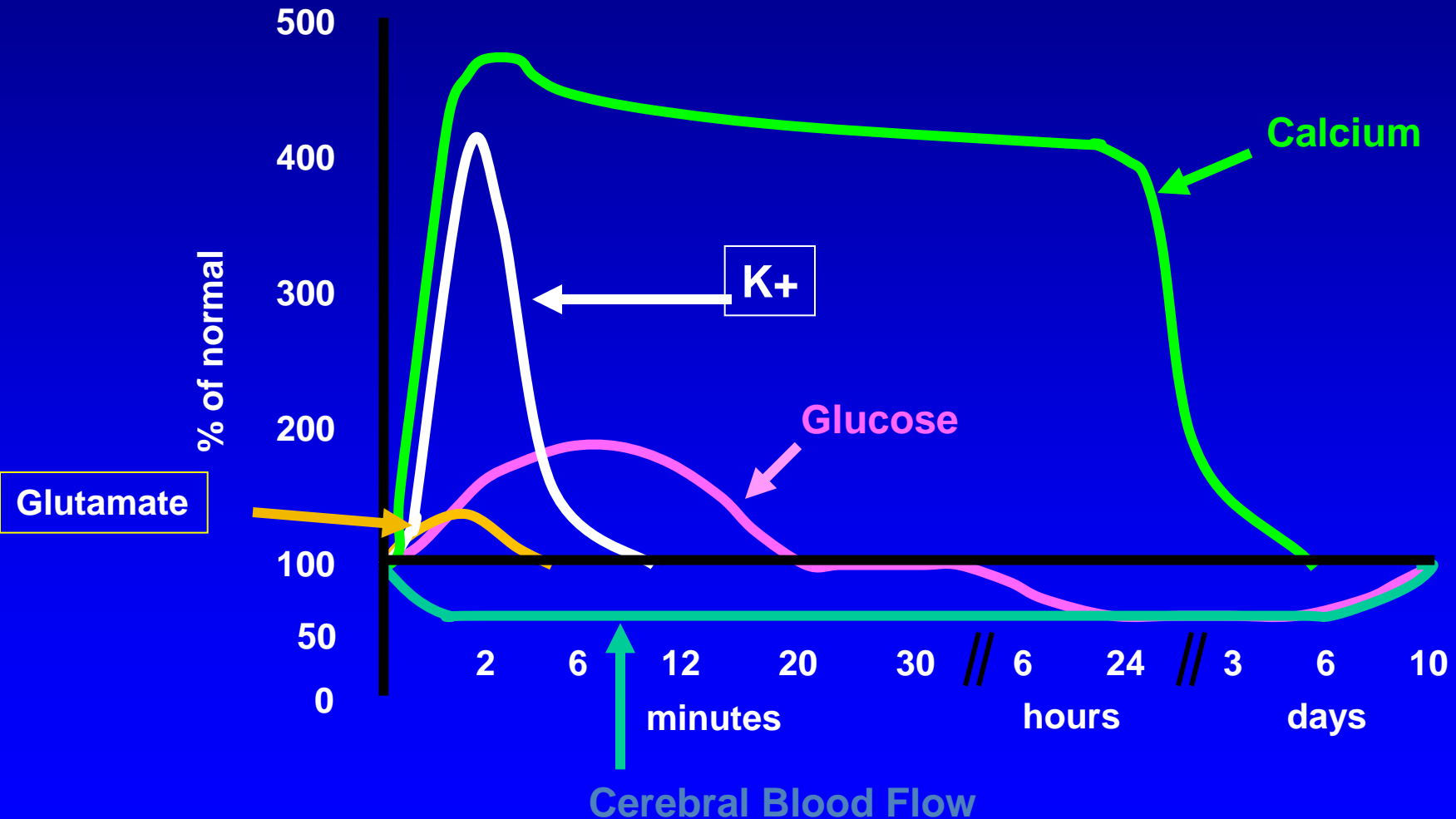


Wake Forest
School of Medicine

Joel Stitzel, jstitzel@wakehealth.edu

Neurometabolic Cascade Following Traumatic Brain Injury

(Giza & Hovda, 2001)



Signs of a Concussion

(what you observe)

Cognitive

- Appears dazed/stunned
- Confused about events (assignment or position)
- Answers questions more slowly
- Repeats questions/ forgets instruction or play
- Can't recall events prior to or after the hit/fall

Physical

- Vomiting
- Loses consciousness
- Balance problems
- Moves clumsily
- Drowsy

Behavior/Emotion

- Behavior or personality changes



Symptoms of a Concussion

(what they feel and report)

Physical

- Headache
- Fatigue
- Visual problems (blurry/"double")
- Nausea/vomiting
- Balance problems/ dizziness
- Sensitivity to light/noise
- Numbness/tingling

Sleep

- Sleeping more/less
- Trouble falling asleep
- Drowsiness

Cognitive

- Mental fogginess
- Difficulty concentrating
- Difficulty remembering
- Feeling slowed down

Emotional

- More emotional
- Irritable
- Sad
- Nervous



Epidemiology of Recovery

Our Best Guess

- Research literature is still limited with respect to understanding concussion recovery outcomes across full age range, and for boys and girls (IOM, 2013).
- Be careful about expecting “7-10 days” for recovery.
- Perhaps 80-90% recovery within 1-3 weeks.
- Prolonged recovery for 10-20%.



ACUTE CONCUSSION EVALUATION (ACE)

Physician/Clinician Office Version

Gerard Giola, PhD¹ & Micky Collins, PhD²

¹Children's National Medical Center

²University of Pittsburgh Medical Center

Patient Name _____

DOB: _____ Age: _____

Date: _____ ID/MR# _____

A. Injury Characteristics Date/Time of Injury: _____ Reporter: ☐ Patient ☐ Parent ☐ Spouse ☐ Other _____

1. Injury Description _____

1a. Is there evidence of a forcible blow to the head (direct or indirect)? ☐ Yes ☐ No ☐ Unknown

1b. Is there evidence of intracranial injury or skull fracture? ☐ Yes ☐ No ☐ Unknown

1c. Location of Impact: ☐ Frontal ☐ Lt Temporal ☐ Rt Temporal ☐ Lt Parietal ☐ Rt Parietal ☐ Occipital ☐ Neck ☐ Indirect Force

2. Cause: ☐ MVC ☐ Pedestrian-MVC ☐ Fall ☐ Assault ☐ Sports (specify) _____ Other _____

3. **Amnesia Before** (Retrograde) Are there any events just BEFORE the injury that you/ person has no memory of (even brief)? ☐ Yes ☐ No Duration _____

4. **Amnesia After** (Anterograde) Are there any events just AFTER the injury that you/ person has no memory of (even brief)? ☐ Yes ☐ No Duration _____

5. **Loss of Consciousness:** Did you/ person lose consciousness? ☐ Yes ☐ No Duration _____

6. **EARLY SIGNS:** ☐ Appears dazed or stunned ☐ Is confused about events ☐ Answers questions slowly ☐ Repeats Questions ☐ Forgetful (recent info)

7. **Seizures:** Were seizures observed? No ☐ Yes ☐ Detail _____

B. Symptom Check List* Since the injury, has the person experienced any of these symptoms any more than usual today or in the past day?

Indicate presence of each symptom (0=No, 1=Yes).

*Lovell & Collins, 1998 JHTR

| PHYSICAL (10) | | COGNITIVE (4) | | SLEEP (4) | |
|--|-----|----------------------------|-----|---|---------|
| Headache | 0 1 | Feeling mentally foggy | 0 1 | Drowsiness | 0 1 |
| Nausea | 0 1 | Feeling slowed down | 0 1 | Sleeping less than usual | 0 1 N/A |
| Vomiting | 0 1 | Difficulty concentrating | 0 1 | Sleeping more than usual | 0 1 N/A |
| Balance problems | 0 1 | Difficulty remembering | 0 1 | Trouble falling asleep | 0 1 N/A |
| Dizziness | 0 1 | COGNITIVE Total (0-4) | | SLEEP Total (0-4) | |
| Visual problems | 0 1 | EMOTIONAL (4) | | Exertion: Do these symptoms <u>worsen</u> with: Physical Activity __Yes __No __N/A Cognitive Activity __Yes __No __N/A Overall Rating: How <u>different</u> is the person acting compared to his/her usual self? (circle) Normal 0 1 2 3 4 5 6 Very Different | |
| Fatigue | 0 1 | Irritability | 0 1 | | |
| Sensitivity to light | 0 1 | Sadness | 0 1 | | |
| Sensitivity to noise | 0 1 | More emotional | 0 1 | | |
| Numbness/Tingling | 0 1 | Nervousness | 0 1 | | |
| PHYSICAL Total (0-10) | | EMOTIONAL Total (0-4) | | | |
| (Add Physical, Cognitive, Emotion, Sleep totals) | | Total Symptom Score (0-22) | | | |

C. Risk Factors for Prolonged Recovery (check all that apply)

| Concussion History? Y N | Headache History? Y N | Developmental History | Psychiatric History |
|---|------------------------------|--|----------------------------|
| Previous # 1 2 3 4 5 | Prior treatment for headache | Learning disabilities | Anxiety |
| Longest symptom duration | History of migraine headache | Attention-Deficit/Hyperactivity Disorder | Depression |
| Days _____ Weeks _____ Months _____ Years _____ | Personal _____ Family _____ | Other developmental disorder | Sleep disorder |
| If multiple concussions, less force caused reinjury? Yes No | | | Other psychiatric disorder |

List other comorbid medical disorders or medication usage (e.g., hypothyroid, seizures)

D. RED FLAGS for acute emergency management: Refer to the emergency department with sudden onset of any of the following:

- * Headache that worsens
- * Looks very drowsy/ can't be awakened
- * Can't recognize people or places
- * Neck pain
- * Seizures
- * Repeated vomiting
- * Increasing confusion or irritability
- * Unusual behavioral change
- * Focal neurologic signs
- * Slurred speech
- * Weakness or numbness in arms/legs
- * Change in state of consciousness

E. Diagnosis (ICD): ☐ Concussion w/o LOC 850.0 ☐ Concussion w/ LOC 850.1 ☐ Concussion (Unspecified) 850.9 ☐ Other (854) _____
☐ No diagnosis

F. Follow-Up Action Plan Complete ACE Care Plan and provide copy to patient/family.

☐ No Follow-Up Needed

☐ Physician/ Clinician Office Monitoring: Date of next follow-up _____

☐ Referral:

☐ Neuropsychological Testing

☐ Physician: Neurosurgery _____ Neurology _____ Sports Medicine _____ Physiatrist _____ Psychiatrist _____ Other _____

☐ Emergency Department

ACE Completed by: _____ MD RN NP PhD ATC

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Acute Concussion Evaluation (ACE)

A. Injury Characteristics

Injury Description

Cause

Amnesias (retrograde, anterograde)

Loss of Consciousness (LOC), Seizures

Early Signs

| | | | | | | | |
|---|---------------------|--------------|-----------|---|---------------------------------|---------------------------------|--------------------------------|
| A. Injury Characteristics | Date/Time of Injury | May 30, 2007 | Reporter: | Patient <input checked="" type="checkbox"/> | Parent <input type="checkbox"/> | Spouse <input type="checkbox"/> | Other <input type="checkbox"/> |
| 1. Injury Description | | | | | | | |
| Fell to ground, hit head on ground and then kneed in right temporal region; dazed initially but continued to play with bad headache. Felt sluggish and confused. | | | | | | | |
| 1a. Is there evidence of a forcible blow to the head (direct or indirect)? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Unknown | | | | | | | |
| 1b. Is there evidence of intracranial injury or skull fracture? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Unknown | | | | | | | |
| 1c. Location of Impact: <input type="checkbox"/> Frontal <input type="checkbox"/> Lft Temporal <input checked="" type="checkbox"/> Rt Temporal <input type="checkbox"/> Lft Parietal <input type="checkbox"/> Rt Parietal <input checked="" type="checkbox"/> Occipital <input type="checkbox"/> Neck <input type="checkbox"/> Indirect Force | | | | | | | |
| 2. Cause: <input type="checkbox"/> MVC <input type="checkbox"/> Pedestrian-MVC <input type="checkbox"/> Fall <input type="checkbox"/> Assault <input checked="" type="checkbox"/> Sports (specify) basketball <input type="checkbox"/> Other | | | | | | | |
| 3. Amnesia Before (Retrograde) Are there any events just BEFORE the injury that you/ person has no memory of (even brief)? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Duration | | | | | | | |
| 4. Amnesia After (Anterograde) Are there any events just AFTER the injury that you/ person has no memory of (even brief)? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Duration | | | | | | | |
| 5. Loss of Consciousness: Did you/ person lose consciousness? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Duration | | | | | | | |
| 6. EARLY SIGNS: <input checked="" type="checkbox"/> Appears dazed or stunned <input type="checkbox"/> Is confused about events <input checked="" type="checkbox"/> Answers questions slowly <input type="checkbox"/> Repeats Questions <input type="checkbox"/> Forgetful (recent info) | | | | | | | |
| 7. Seizures: Were seizures observed? <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes Detail | | | | | | | |

Acute Concussion Evaluation (ACE)

B. Symptom Checklist

B. Symptom Check List* Since the injury, has the person experienced any of these symptoms any more than usual today or in the past day?

Indicate presence of each symptom (0=No, 1=Yes).

*Lovell & Collins, 1998 JHTR

| PHYSICAL (10) | | COGNITIVE (4) | | SLEEP (4) | |
|--|-----|--------------------------|-----|---|---------|
| Headache | 0 1 | Feeling mentally foggy | 0 1 | Drowsiness | 0 1 |
| Nausea | 0 1 | Feeling slowed down | 0 1 | Sleeping less than usual | 0 1 N/A |
| Vomiting | 0 1 | Difficulty concentrating | 0 1 | Sleeping more than usual | 0 1 N/A |
| Balance problems | 0 1 | Difficulty remembering | 0 1 | Trouble falling asleep | 0 1 N/A |
| Dizziness | 0 1 | COGNITIVE Total (0-4) | ___ | SLEEP Total (0-4) | ___ |
| Visual problems | 0 1 | EMOTIONAL (4) | | | |
| Fatigue | 0 1 | Irritability | 0 1 | Exertion: Do these symptoms <u>worsen</u> with: Physical Activity ___Yes ___No <input checked="" type="checkbox"/> N/A Cognitive Activity <input checked="" type="checkbox"/> Yes ___No ___N/A | |
| Sensitivity to light | 0 1 | Sadness | 0 1 | | |
| Sensitivity to noise | 0 1 | More emotional | 0 1 | | |
| Numbness/Tingling | 0 1 | Nervousness | 0 1 | | |
| PHYSICAL Total (0-10) | ___ | EMOTIONAL Total (0-4) | ___ | Overall Rating: How <u>different</u> is the person acting compared to his/her usual self? (circle) Normal 0 1 2 3 4 5 6 Very Different | |
| (Add Physical, Cognitive, Emotion, Sleep totals) | | | | | |
| Total Symptom Score (0-22) | | | | ___ | |

Acute Concussion Evaluation (ACE)

C. Risk Factors for Protracted Recovery

| C. Risk Factors for Protracted Recovery (check all that apply) | | | | | | |
|---|---|--|---|--|---|---------------------|
| Concussion History? Y <input type="checkbox"/> N <input checked="" type="checkbox"/> | ✓ | Headache History? Y <input checked="" type="checkbox"/> N <input type="checkbox"/> | ✓ | Developmental History | ✓ | Psychiatric History |
| Previous # 1 2 3 4 5 | | Prior treatment for headache | | Learning disabilities | | Anxiety |
| Longest symptom duration Days__ Weeks__ Months__ Years__ | ✓ | History of migraine headache ___ Personal ___ Family | ✓ | Attention-Deficit/ Hyperactivity Disorder | | Depression |
| If multiple concussions, less force caused reinjury? Yes__ No__ | | | | Other developmental disorder | | Sleep disorder |
| Other psychiatric disorder | | | | | | |
| List other comorbid medical disorders or medication usage (e.g., hypothyroid, seizures) | | | | | | |

Research findings have linked these risk factors to longer periods of recovery

Acute Concussion Evaluation (ACE)

D. Red Flags for Neurological Deterioration

| | | | |
|---|--|--|------------------------------------|
| D. RED FLAGS for acute emergency management: Refer to the emergency department with <u>sudden onset</u> of any of the following: | | | |
| * Headaches that worsen | * Looks very drowsy/ can't be awakened | * Can't recognize people or places | * Neck pain |
| * Seizures | * Repeated vomiting | * Increasing confusion or irritability | * Unusual behavioral change |
| * Focal neurologic signs | * Slurred speech | * Weakness or numbness in arms/legs | * Change in state of consciousness |

Physicians, parents/ patients, school health need to be aware of danger signs that signal the need for emergency care.

Be alert for symptoms that worsen over time. The student should be seen in an emergency department right away if s/he has:

- [illegible]

Return to ~~Learn~~

Life in School

School:

- Kid's Major "Job" is new learning/ acquiring knowledge
- Practicing incompletely learned knowledge (HW)
- Mental and physical exertion is essential to new learning/ practice

ALSO:

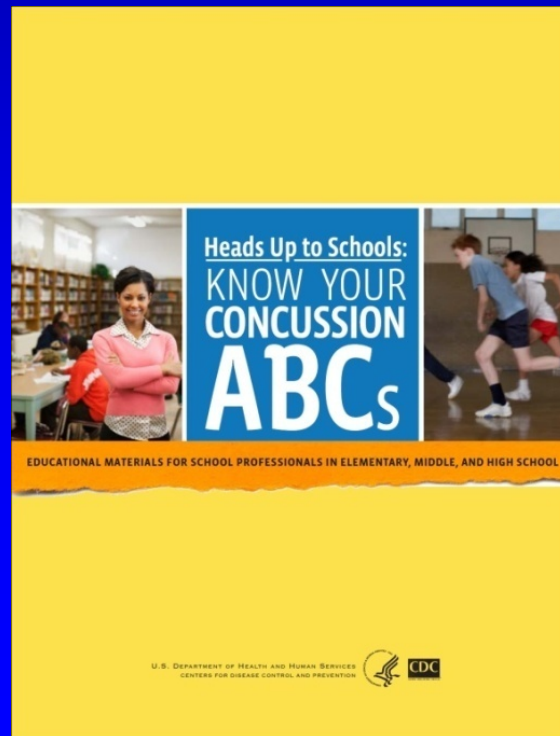
- Social with peers
- Interacting with teachers
- Managing the environment
- Academic pressure



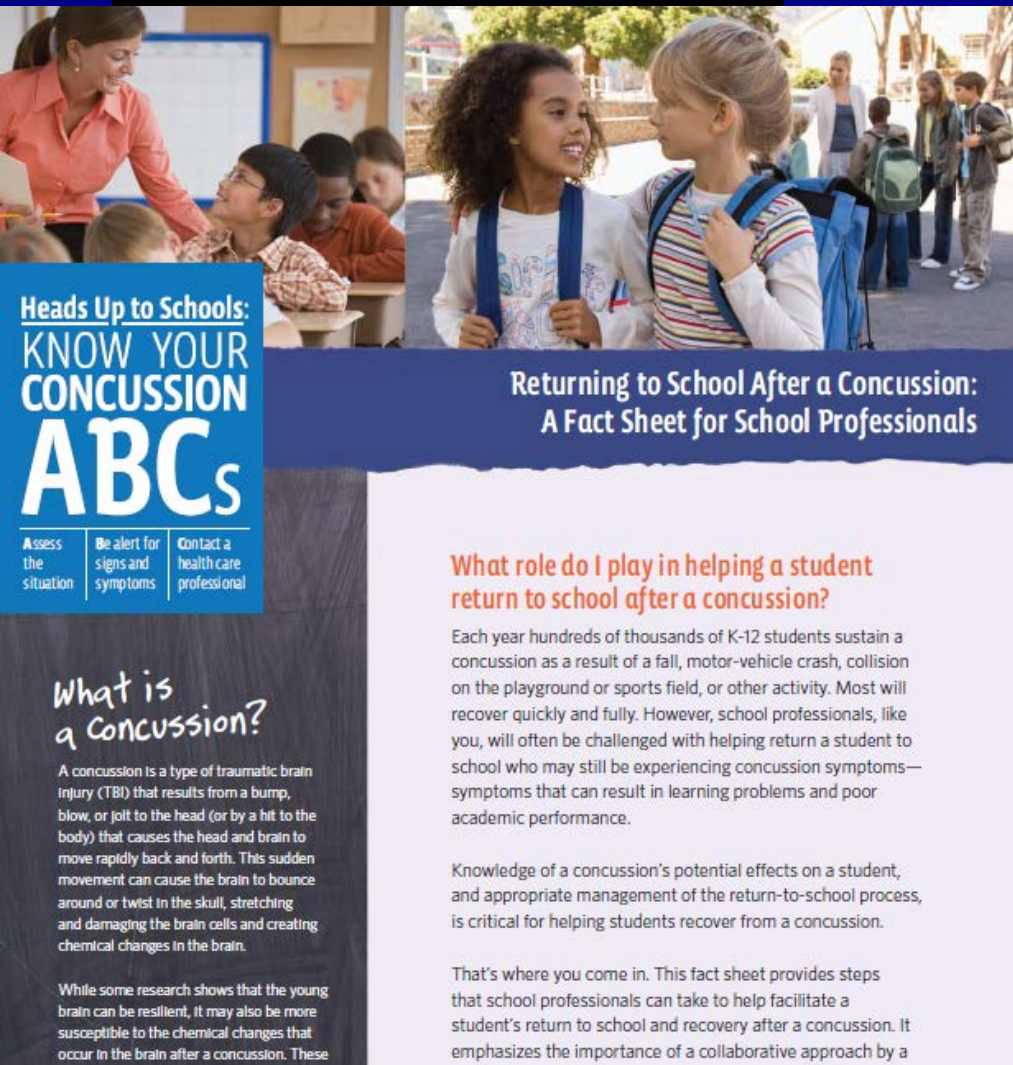
Concussion/ mTBI CDC Educational Materials

www.cdc.gov/concussion

Heads Up to Schools: Know Your Concussion ABCs



2012



**Heads Up to Schools:
KNOW YOUR
CONCUSSION
ABCs**

Assess the situation Be alert for signs and symptoms Contact a health care professional

What is a Concussion?

A concussion is a type of traumatic brain injury (TBI) that results from a bump, blow, or jolt to the head (or by a hit to the body) that causes the head and brain to move rapidly back and forth. This sudden movement can cause the brain to bounce around or twist in the skull, stretching and damaging the brain cells and creating chemical changes in the brain.

While some research shows that the young brain can be resilient, it may also be more susceptible to the chemical changes that occur in the brain after a concussion. These

Returning to School After a Concussion: A Fact Sheet for School Professionals

What role do I play in helping a student return to school after a concussion?

Each year hundreds of thousands of K-12 students sustain a concussion as a result of a fall, motor-vehicle crash, collision on the playground or sports field, or other activity. Most will recover quickly and fully. However, school professionals, like you, will often be challenged with helping return a student to school who may still be experiencing concussion symptoms—symptoms that can result in learning problems and poor academic performance.

Knowledge of a concussion's potential effects on a student, and appropriate management of the return-to-school process, is critical for helping students recover from a concussion.

That's where you come in. This fact sheet provides steps that school professionals can take to help facilitate a student's return to school and recovery after a concussion. It emphasizes the importance of a collaborative approach by a

1. What role do I play in helping a student return to school?
2. How can a concussion affect learning?
3. When is a student ready to return to school after a concussion?
4. Who should be included as part of the support team?
5. How can understanding concussion symptoms help with identifying a student's individual needs?
6. What roles to cognitive exertion and rest play in a student's recovery?
7. How can I help identify problems and needs?
8. Some strategies for Addressing Concussion Symptoms at school.
9. When symptoms persist: What types of formal supports are available?

School and the Concussed Youth: Recommendations for Concussion Education and Management

Maegan D. Sady, PhD^{a,*}, Christopher G. Vaughan, PsyD^{a,b,c},
Gerard A. Gioia, PhD^{a,b,c}

KEYWORDS

- Concussion • Mild traumatic brain injury
- Student • School • Accommodations • N

Original Article

Medical-School Partnership in Guiding Return to School Following Mild Traumatic Brain Injury in Youth

Gerard A. Gioia, PhD¹

Abstract

Mild traumatic brain injury is recognized as a prevalent and significant risk concern for youth. Appropriate school return is particularly challenging. The medical and school systems must be prepared partners to support the school return of the student with mild traumatic brain injury. Medical providers must be trained in assessment and management skills with a focused understanding of school demands. Schools must develop policies and procedures to prepare staff to support a gradual return process with the necessary academic accommodations. Ongoing communication between the family, student, school, and medical provider is essential to supporting recovery. A systematic gradual return to school process is proposed including levels of recommended activity and criteria for advancement. Targets for intervention are described with associated strategies for supporting recovery. A 10-element Progressive Activities of Controlled Exertion (PACE) model for activity-exertion management is introduced to manage symptom exacerbation. A strong medical-school partnership will maximize outcomes for students with mild traumatic brain injury.

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Do Cognitive & Physical Demands Worsen Symptoms? (Student Report)

| | Elementary (n=88) | | Middle (n=138) | | High School (n=206) | |
|-----------|----------------------|--|-------------------|--|------------------------|--|
| | Yes | | Yes | | Yes | |
| Cognitive | 47.7 | | 52.5 | | 62.5 | |
| Physical | 12.5 | | 20.3 | | 16.5 | |

Academic Effects of Concussion in Children and Adolescents

Ransom, Vaughan, Pratson, Sady, McGill, & Gioia (2015)

- Objective: Examine academic effects in students not yet recovered from concussion (RC-) as compared to recovered (RC+) students
- Sample: 349 students, 5-18 years, and parents within 4 weeks of injury. Two groups: actively symptomatic (RC-) vs. asymptomatic/ recovered (RC+); 3 levels of schooling.
- Measures: academic effects (CLASS), symptoms (PCSI), cognition

What kinds of school problems are you having SINCE YOUR INJURY?

Ransom et al. (2015)

| Type of Problem | Elementary (n=42) | Middle (n=78) | High School (n=120) |
|-----------------------------------|----------------------|------------------|------------------------|
| Headaches interfering | 53% | 73% | 71% |
| Can't pay attention | 47% | 58% | 66% |
| Feeling too tired | 53% | 61% | 52% |
| Homework taking much longer | 35% | 48% | 63%* |
| Difficulty understanding material | 29% | 46% | 54% |
| Difficulty studying for tests | 18% | 36% | 53%* |
| Difficulty taking Notes | 18% | 17% | 35%* |
| Average # reported Mn (SD) | 2.53 (2.1) | 3.37 (1.7) | 3.92 (2.1) |



Academic Effects of Concussion in Children and Adolescents

Ransom, Vaughan, Pratson, Sady, McGill, & Gioia (2015)

- Results: RC- group reported higher levels of concern, more school-related problems than RC+ group.
- High school students report higher levels of problems.
- Higher symptom burden associated with greater reported academic problems.
- Significantly greater impairment on cognitive testing in RC-group.
- Summary: provides first empirical evidence of concussion's impact on learning/ performance reported by students.
Suggests need to identify post-concussion academic effects to target interventions.

Which classes/ subjects are you having trouble with SINCE YOUR INJURY?

| Type of Problem | Elementary (n=27/ 82) | | Middle (n=92/ 122) | | High School (n=147/ 186) | |
|-------------------------|---------------------------|--------|------------------------|--------|------------------------------|--------|
| | Student | Parent | Student | Parent | Student | Parent |
| <i>Reading</i> | 33.3 | 35.4 | 37.0 | 33.6 | 46.3 | 38.9 |
| <i>Math</i> | 29.6 | 34.1 | 54.3 | 38.5 | 59.2 | 50.5 |
| <i>Science</i> | 14.8 | 9.9 | 29.7 | 21.7 | 46.3 | 37.3 |
| <i>Social Studies</i> | 14.8 | 8.6 | 23.1 | 19.0 | 36.1 | 31.7 |
| <i>Foreign Language</i> | 7.4 | 2.5 | 33.7 | 23.8 | 32.0 | 32.3 |
| <i>Art</i> | 0.0 | 2.5 | 5.5 | 2.5 | 3.4 | 4.3 |
| <i>None</i> | 14.8 | 54.9 | 16.3 | 42.6 | 12.9 | 30.1 |

What are you most concerned about?

| Type of Problem | Elementary (n=27) | Middle (n=105) | High School (n=166) |
|------------------------|----------------------|-------------------|------------------------|
| Amount of Work | 28.6 | 21.9 | 25.9 |
| Returning to Sports | 17.9 | 27.6 | 19.9 |
| Ability to Learn | 17.9 | 17.1 | 18.1 |
| GRADES DROPPING | 11.5 | 25.3 | #1 33.3 |

Psychosocial Issues

- Invisible injury
 - TBI not appreciated
 - Look “normal”
- Cut off from social group (team)
- Loss of identity
- Pressures to be “normal”, return & contribute
- Pressure of schoolwork



Psychosocial Issues

- Role of pre-existing anxiety or mood problems (Yeates et al.)
- Family understanding, coping, and capacity for support (Yeates et al.)
- School understanding, capacity for support
- Medical system understanding, capacity for support



Relationship of Emotion, Energy & Recovery

- Emotion is critical to motivating behavior, social interaction, cognitive performance
- Emotional activation requires energy
- Stress, anxiety and disorder of mood requires significant energy
- “Emotional exertion” likely plays a role in facilitating or adversely affecting recovery of concussion (energy crisis)



Treatment (Zurich)

Concussion management

The cornerstone of concussion management is physical and cognitive rest until the acute symptoms resolve and then a graded programme of exertion prior to medical clearance and RTP. The current published evidence evaluating the effect of rest following a sports-related concussion is sparse. An initial period of rest in the acute symptomatic period following injury (24–48 h) may be of benefit. Further research to evaluate the long-term outcome of rest, and the optimal amount and type of rest, is needed. In the absence of evidence-based recommendations, a sensible approach involves the gradual return to school and social activities (prior to contact sports) in a manner that does not result in a significant exacerbation of symptoms.

“New” Management Strategies

“Active” Rehabilitation

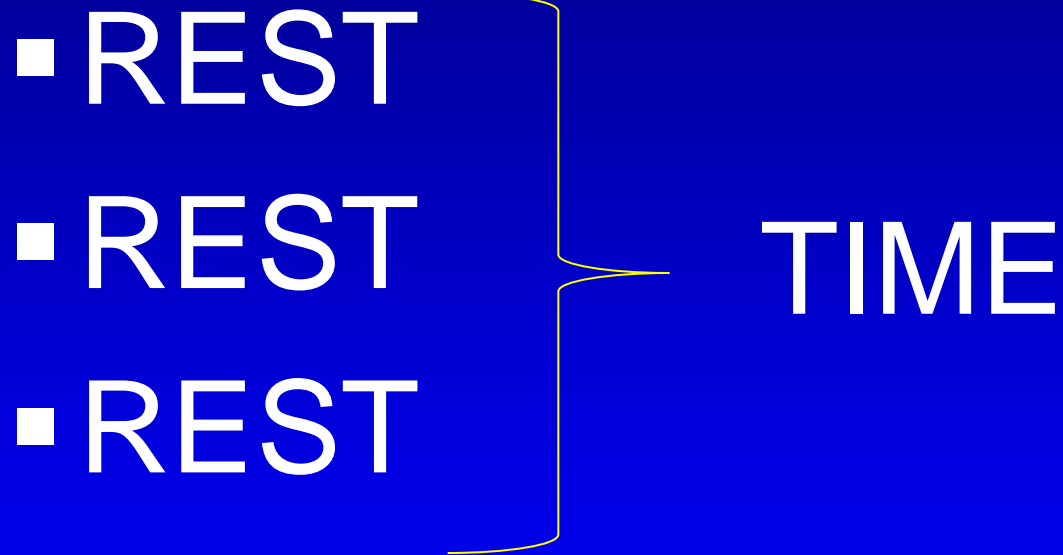
- No additional forces to head/ brain
- INITIALLY, resting the brain (days) & good night sleep
- Individualized moderated, monitored symptom management
 - Managing/ facilitating physiological recovery; teaching symptom monitoring, exertion concepts
 - Find the activity “sweet spot” – Optimized activity w/o over-exertion
 - Not too much BUT not too little
 - Plan of graduated physical and cognitive activation

Ways to over-exert

- » Physical
- » Cognitive (concentration)
- » Emotional (stress)



Historic 4-letter word Approach(es) to Concussion Treatment



(CISG, AAP, etc.)



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The effects of rest and treatment following sport-related concussion: a systematic review of the literature

Kathryn J Schneider,¹ Grant L Iverson,² Carolyn A Emery,^{1,3,4} Paul McCrory,⁵ Stanley A Herring,^{6,7} Willem H Meeuwisse^{1,3}

Data synthesis Three studies met the inclusion criteria for evaluating the effects of rest and twelve for treatment. Low-intensity aerobic exercise may be of benefit.

Conclusions The current evidence evaluating the effect of rest and treatment following SRC is sparse. An initial period of rest may be of benefit. Low-level exercise and multimodal physiotherapy may be of benefit for those who are slow to recover. There is a strong need for high level studies evaluating the effects of rest and treatment following SRC.



Is Rest After Concussion “The Best Medicine?”

- “Practice guidelines recommend an initial period of rest for concussion/ mild traumatic brain injury (MTBI)...
- BUT, compelling evidence that other health conditions can be worsened by inactivity, improved by early mobilization/ exercise...
- Best available evidence suggests that rest exceeding three days is probably more harmful than helpful...
- Gradual resumption of pre-injury activities should begin as soon as tolerated...
- Supervised exercise may benefit patients who are slow to recover...”

Evidence for “Not Too Much” Rest

- In chronic fatigue syndrome, rest is thought to contribute to its maintenance.
- Excessive activity restrictions may play a role in maintenance of chronic pain.
- Low levels of activity may have mental health consequences.
 - Injury or illness appears to raise susceptibility to depression if patients do not engage in their regular reinforcing activities.
 - Activity restrictions has been shown to moderate the relationship between injury/illness and mental health outcome in breast cancer, limb amputation, and stroke
 - Anxiety may also be a cause and consequence of excessive activity restriction. Fear about exacerbating symptoms and/or re-injury

Managed Activity

Concussion in Sports: Postconcussive Activity Levels, Symptoms, and Neurocognitive Performance

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Objective: To examine the role postinjury activity level plays in postconcussive symptoms and performance on neurocognitive tests in a population of student-athletes.

Not too Little, Not Too Much

(80 males, 15 females: age = 15.88 ± 1.35 years) were retrospectively assigned to 1 of 5 groups based on a postinjury activity intensity scale.

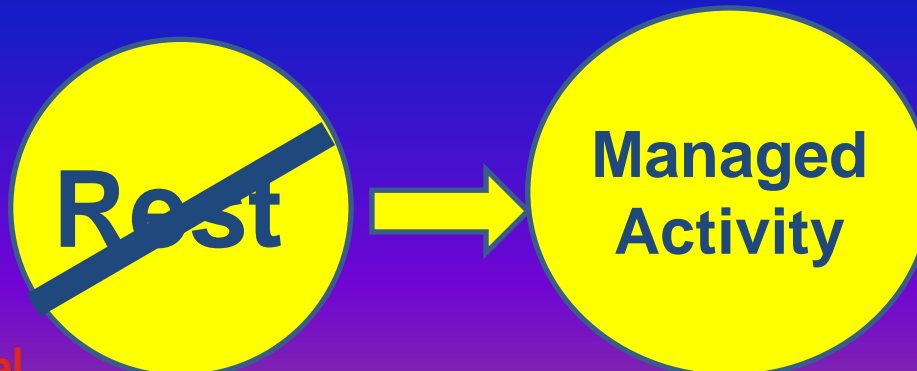
Results: Level of exertion was significantly related to all outcome variables ($P < .02$ for all comparisons). With multivariate analysis, activity intensity remained significant with respect to visual memory ($P = .003$) and reaction time ($P < .001$).

Conclusions: Activity level after concussion affected symptoms and neurocognitive recovery. Athletes engaging in high levels of activity after concussion demonstrated worse neurocognitive performance. For these tasks, those engaging in moderate levels of activity demonstrated the best performance.



Progressive Activities of Controlled Exertion (PACE)

1. Set the Positive Foundation for Recovery
2. Define the Parameters of the Activity-Exertion Schedule
3. Skill Teaching: Activity-Exertion Monitoring/Management
4. Reinforcing the Progressive Path to Recovery



Four Stages/ Ten Elements of PACE Treatment

Set the Positive Foundation for Recovery

1. Positive, active problem-solving context - activity-exertion management will reduce symptoms
2. Assess and manage emotional response to injury (e.g., ask about school stress)
3. Developmentally appropriate education about mTBI and its effects



Four Stages/ Ten Elements of PACE Treatment

Define the Parameters of the Activity-Exertion Schedule

4. Define daily schedule, including type, intensity & duration of cognitive & physical activities & exertional effects

5. Define tolerability for activity intensity and duration

“Dosing” school
How much can the student handle?



Four Stages/ Ten Elements of PACE Treatment

Skill Teaching: Activity-Exertion Monitoring/ Management

6. Teach “Not too little, not too much” concept
7. Teach “reasonable” symptom monitoring
8. Work to tolerable limits – work-rest-work-rest



Exertional “Effects” Response As Target of Interest/ Intervention

- Exertional Effects = symptom exacerbation following physical, cognitive, emotional activity
- Possible signal that brain’s neurometabolism pushed beyond tolerable limits
- Child’s sensitivity to symptom exacerbation / exertional effects hypothesized as indicator of injury status.
- Possible treatment/ management implications (i.e., Controlled Exertion)

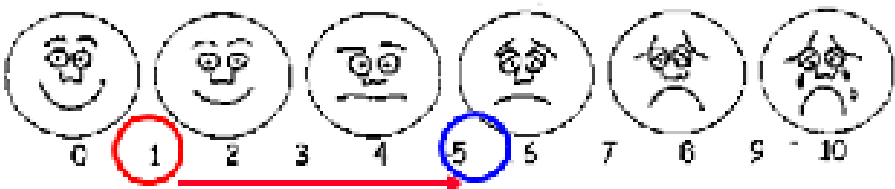


Exertional Effects

Name: _____ Date: ____/____/____

Pre / Post

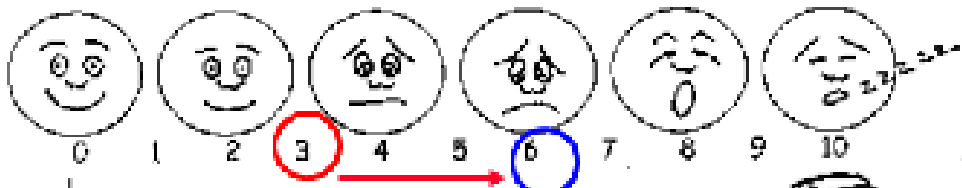
1. Headache



0 1 2 3 4 5 6 7 8 9 10

Pre: 1 / Post: 5

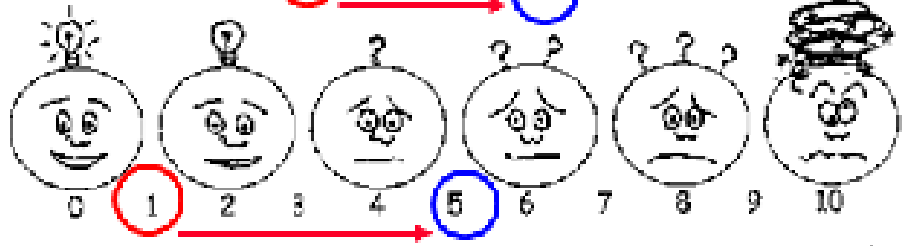
2. Fatigue



0 1 2 3 4 5 6 7 8 9 10

Pre: 3 / Post: 6

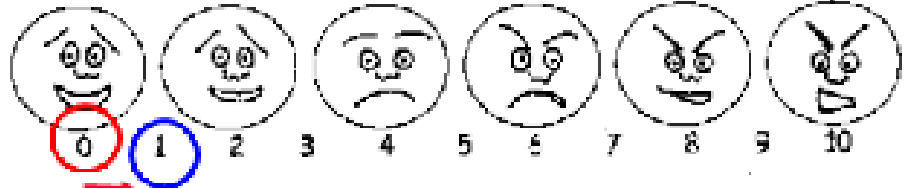
3. Concentration



0 1 2 3 4 5 6 7 8 9 10

Pre: 1 / Post: 5

4. Irritability



0 1 2 3 4 5 6 7 8 9 10

Pre: 0 / Post: 1

5. _____

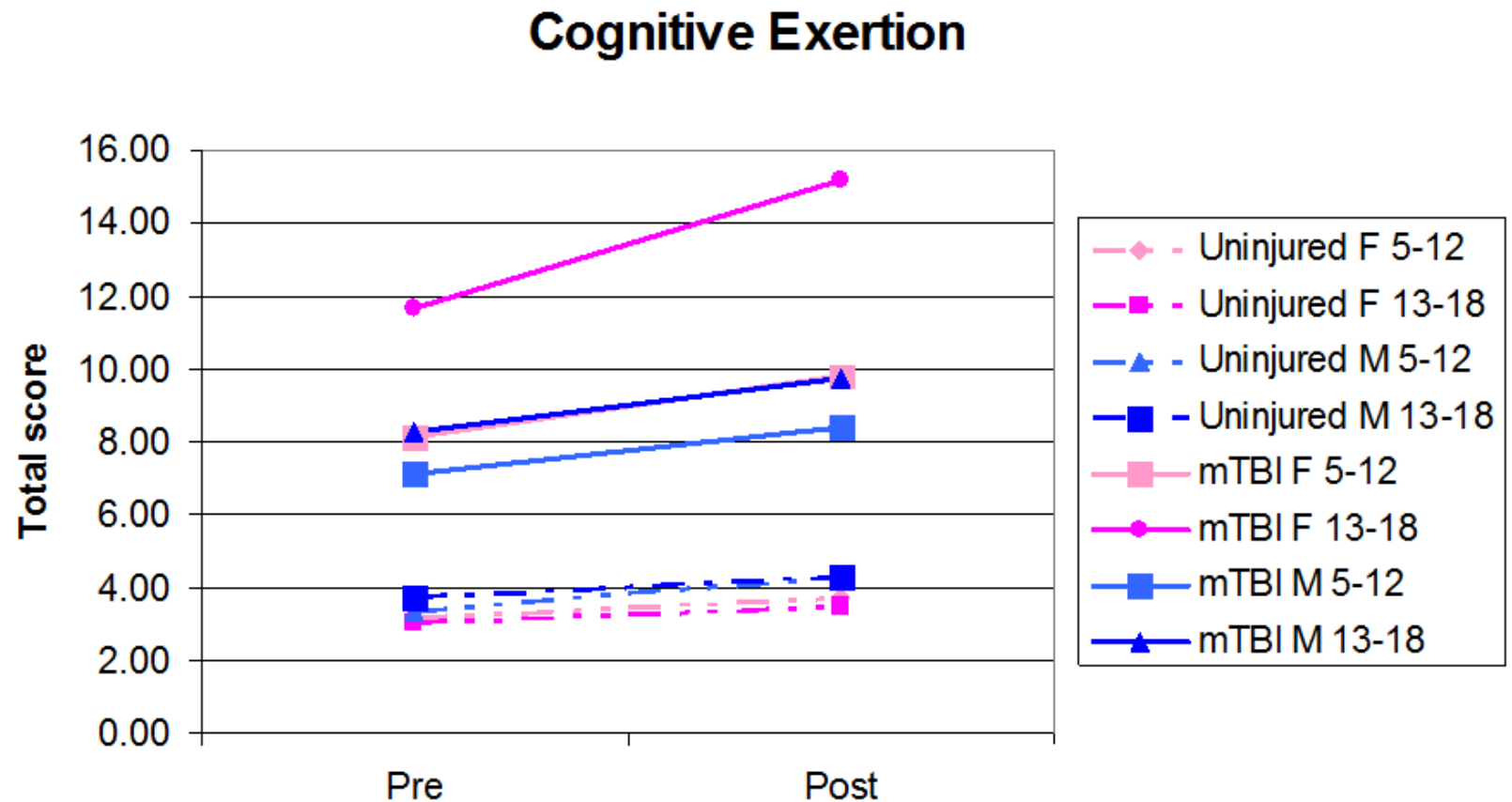
0 1 2 3 4 5 6

Indicate symptom rating at the beginning of the testing session (Pre) AND at the end of it (Post). (e.g., sensitivity to light and/or sound, etc.) is appropriate, but not about headache, fatigue, concentration, etc.)

Exertion Effects Index
Difference Score = 17 - 5 = 12

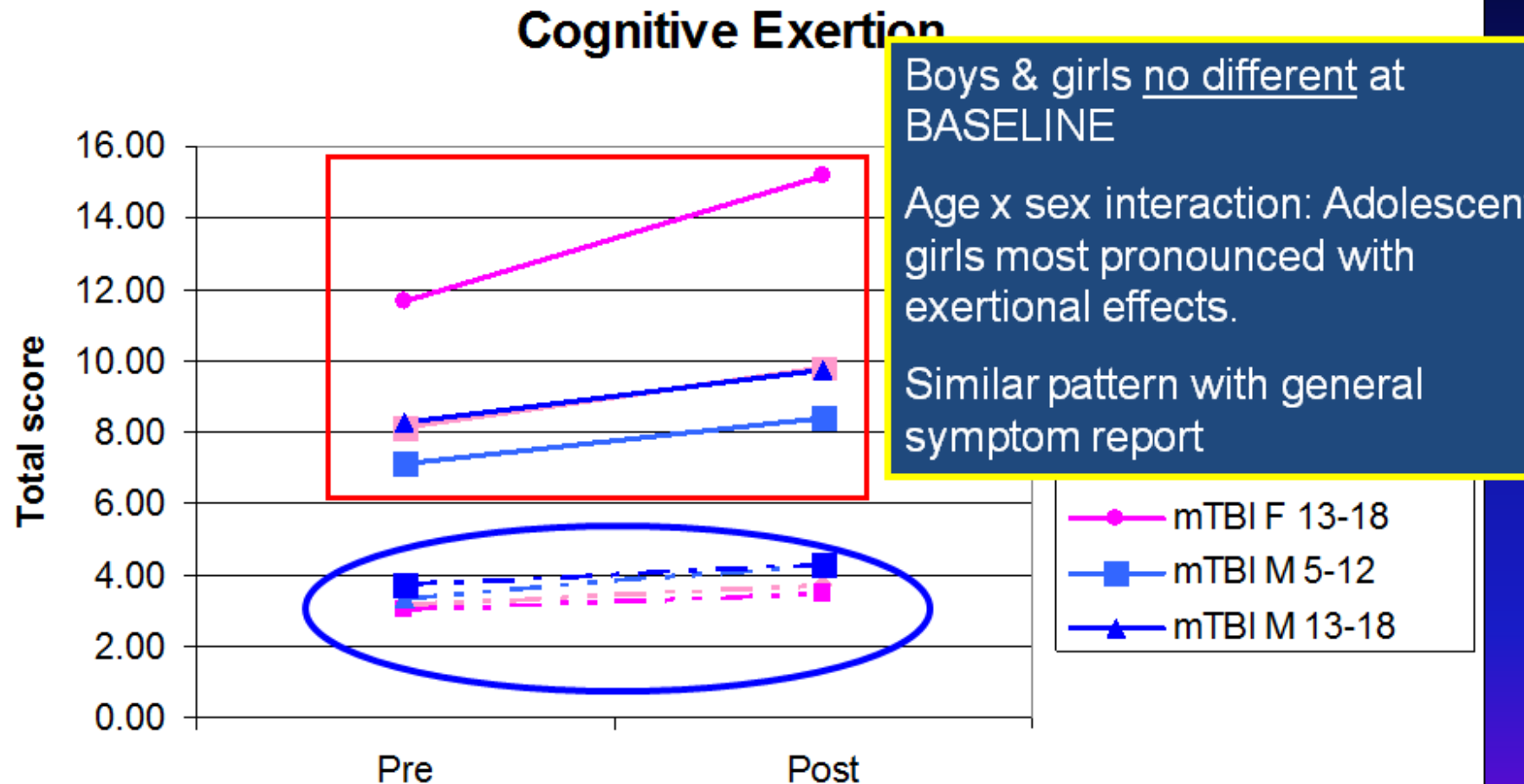
Cognitive Exertion Effects

Age x Sex

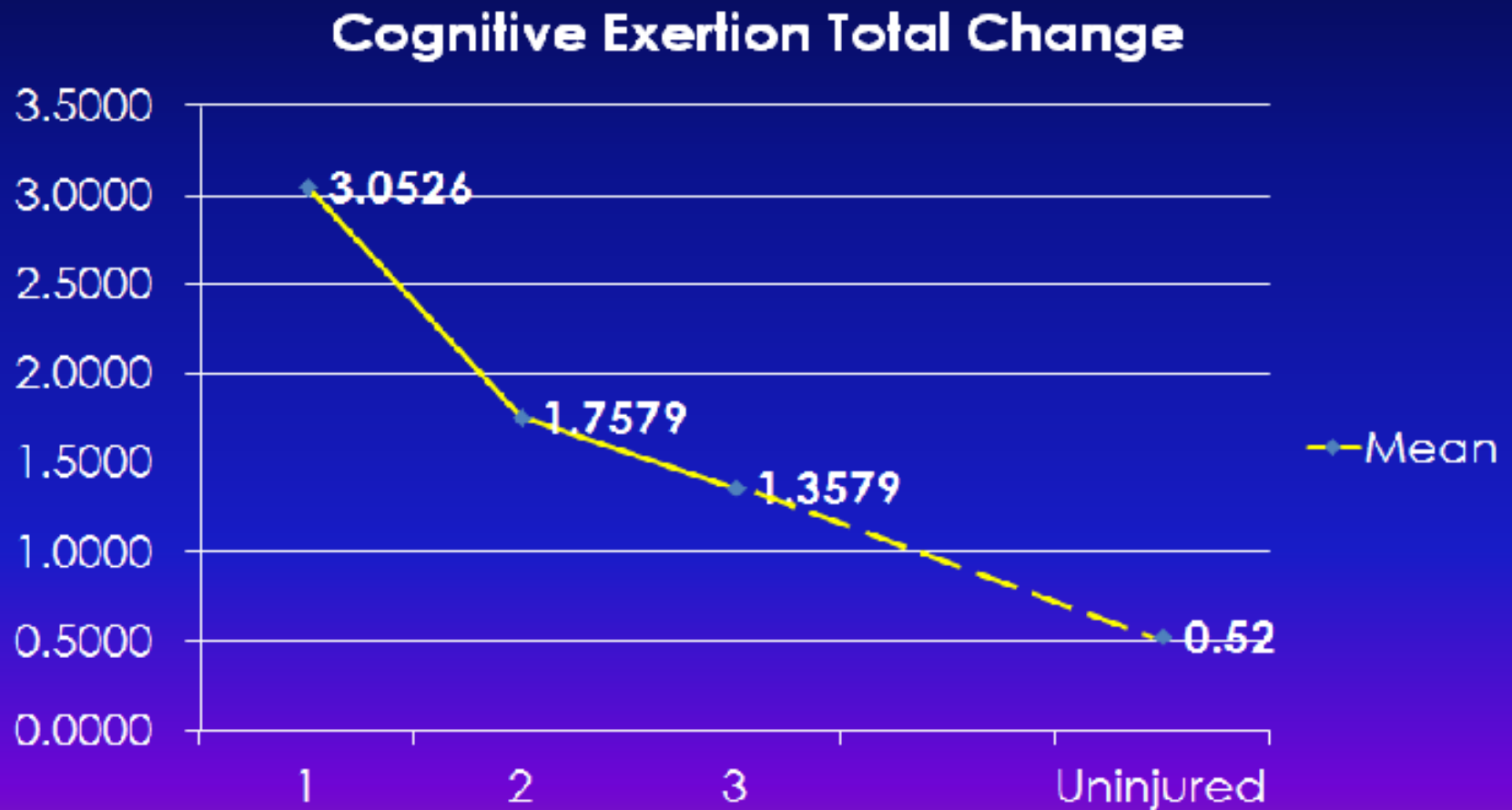


Cognitive Exertion Effects

Age x Sex



Cognitive Exertion Recovery



Gradual Return to School

Six Stages

| Stage | Description |
|-------|---|
| 0 | No return, at home |
| 1 | Return to School, Partial Day (1-3 hours) |
| 2 | Full Day, Maximal Supports (required throughout day) |
| 3 | Return to Full Day, Moderate Supports (provided in response to symptoms during day) |
| 4 | Return to Full Day, Minimal Supports (Monitor final recovery) |
| 5 | Full Return, No Supports Needed |

Gradual Return to School

Six Stages w Recommended Activity Level & Criteria for Movement

| Stage | Description | Activity Level | Criteria to Move to Next Stage |
|-------|--------------------|--|---|
| 0 | No return, at home | <p>Day 1 - Maintain low level cognitive and physical activity. No prolonged concentration.</p> <p>Cognitive Readiness Challenge: As symptoms improve, try reading or math challenge task for 10-30 minutes; assess for symptom increase.</p> | <p>To Move To Stage 1:</p> <p>(1) Student can sustain concentration for 30 minutes before significant symptom exacerbation,</p> <p>AND</p> <p>(2) Symptoms reduce or disappear with cognitive rest breaks* allowing return to activity.</p> |
| | | | |
| | | | |
| | | | |
| | | | |

Table 2

Accommodations for postconcussion effects affecting school

| Postconcussion Effect | Functional School Problem |
|------------------------------------|--|
| <u>Neuropsychological deficits</u> | |
| Attention/concentration | Short focus on lecture, classwork, homework |
| Working memory | Holding instructions in mind, reading comprehension, mathematics calculation, writing |
| Memory consolidation/ retrieval | Retaining new information, accessing learned information when needed |
| Processing speed | Keep pace with work demand, process verbal information effectively |
| Fatigue | Decreased arousal/activation to engage basic attention, working memory |
| <u>Symptoms</u> | |
| Headaches | Interferes with concentration |
| Light/noise sensitivity | Symptoms worsen in bright or loud environments |

| Postconcussion Effect | Functional School Problem | Accommodation/ Management Strategy |
|----------------------------|---|---------------------------------------|
| Dizziness/balance problems | Unsteadiness when walking | |
| Sleep disturbance | Decreased arousal, shifted sleep schedule | |
| Anxiety | Can interfere with concentration, student may push through symptoms to prevent falling behind | |
| Depression/withdrawal | Withdrawal from school or friends because of stigma or activity restrictions | |
| Cognitive symptoms | Concentrating, learning | |
| Symptom sensitivity | Symptoms worsen with overactivity, resulting in any of the earlier-mentioned problems | |

“Active” Aerobic Rehabilitation

- Aerobic Activation (Gagnon et al., 2009; Leddy et al, 2010)
- Structured and monitored subsymptom threshold exercise to facilitate healing in slow to recovery (>3-4 weeks).
- Progressive “controlled” exercise below level that produces symptom occurrence or worsening.

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REVIEW ARTICLE

Exercise, Nutrition and the Brain

Romain Meeusen

Benefits of Aerobic Activity

Logic Model Rehabilitation intervention for slow to recover children after a mild traumatic brain injury

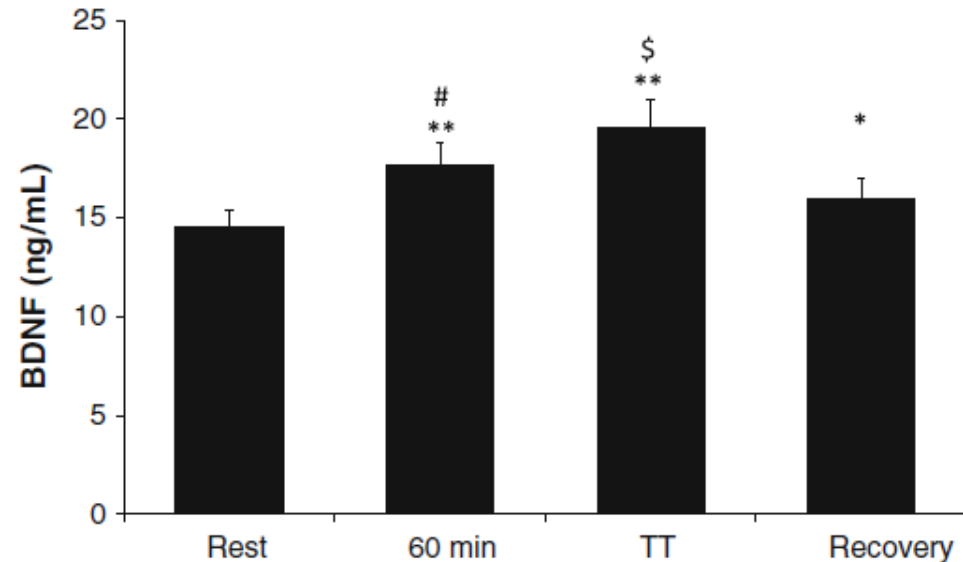
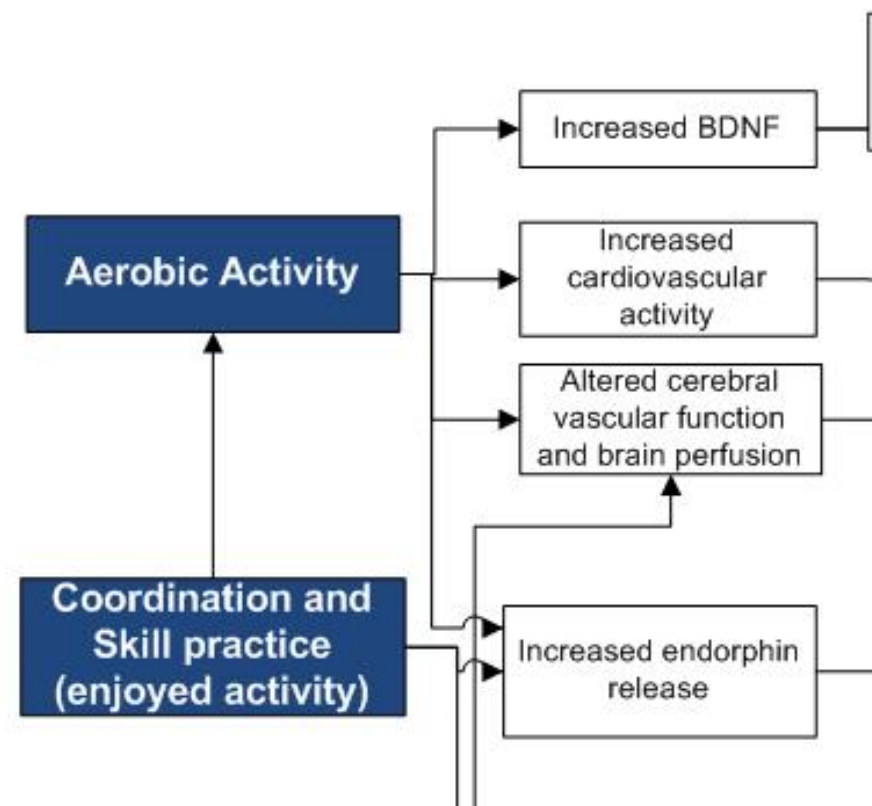
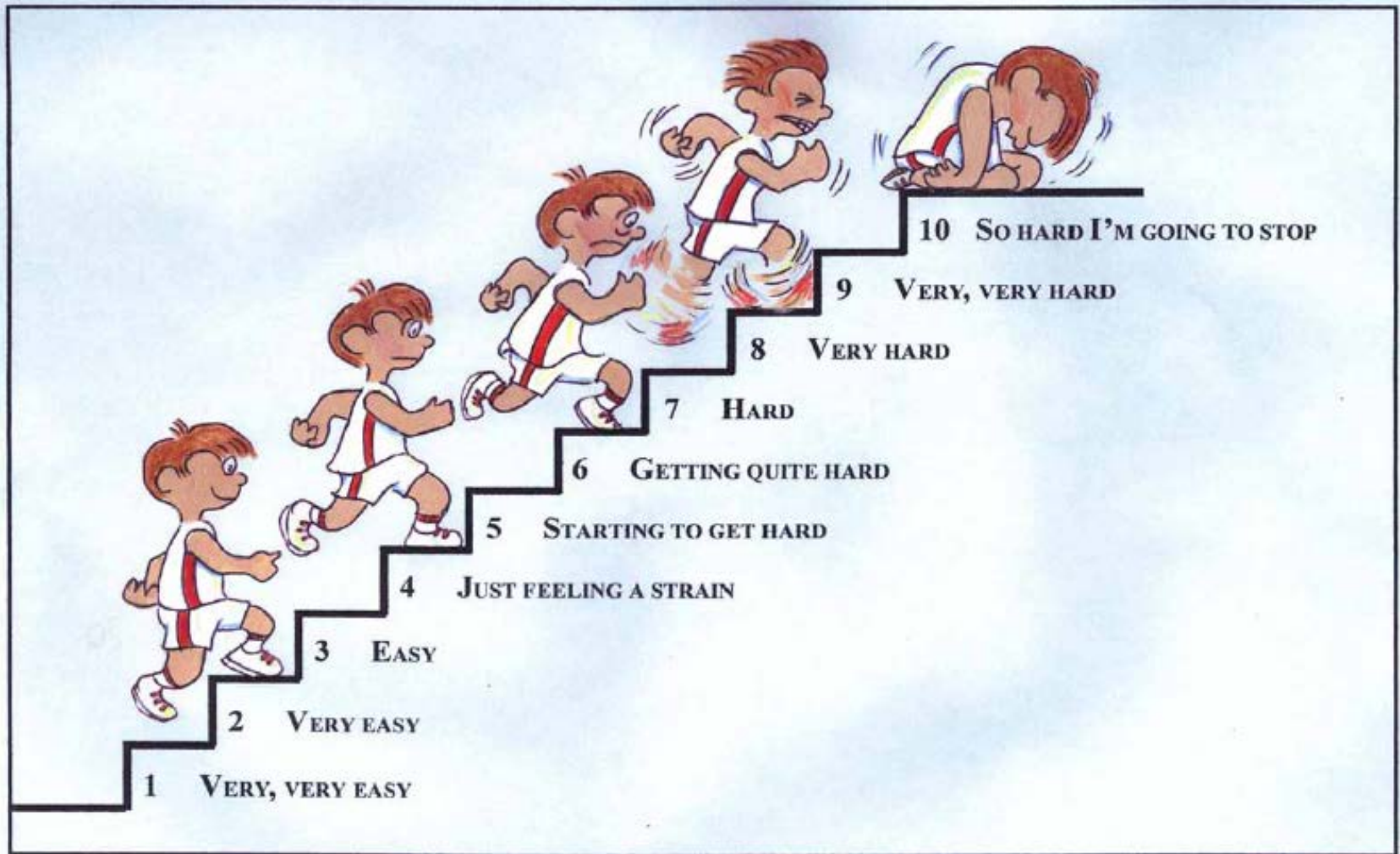


Fig. 1 Serum BDNF concentration (ng/mL, mean \pm SD) at rest, after 60 min of cycling at 55 % of maximum wattage, after a TT and following 15 min of recovery, performed in an environmental temperature of 18 °C under placebo treatment ($n = 22$). Reproduced with modification from Goekint [26], with permission. *Significantly different from rest ($p < 0.05$); **significantly different from rest ($p < 0.01$); #significantly different from rest ($p < 0.01$) and recovery ($p < 0.05$); \$significantly different from rest, 60 min and recovery ($p < 0.01$). BDNF brain-derived neurotrophic factor, SD standard deviation, TT time trial

Pictorial Children's Effort Rating Table





STR PROGRESS LOG

Name

Therapist:

[illegible]

A Student is Identified with a Mild TBI/ Concussion

What Do You Do?



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The Team

- School nurse, psychologist, athletic trainer,
- Guidance counselor
- Administrator
- Teacher(s)
- Healthcare Provider(s) (consulting)
- Family



Post-Injury School Management Procedural Steps Before School Return

| Activity | Procedures |
|---|---|
| A. Medical evaluation 1. Injury Diagnosed; symptom profile defined 2. School Admin/ Teacher Informed of Injury | School makes or receives initial plan for school return - Notification of Probable Head Injury - ACE Care Plan |
| B. Gradual Return to School Decision Criteria | <u>Return to School when:</u> 1. Key symptoms (headache, fatigue, fogginess, sensitivity to light/noise, dizziness) are tolerable 2. Mild level at start of day, responsive to rest 3. Medically determined to tolerate 30+ minutes of cognitive activity |

Post-Injury School Management Procedural Steps

In-School Programming

| Activity | Personnel | Procedures |
|--|------------------|--|
| A. Concussion Team Informed <ul style="list-style-type: none">- Initial accommodations defined- Team Leader informs teachers of symptoms and likely accommodations | Team leader | Based on symptom status, school team determines plan for reduced schedule and participation, and for gradual increase as tolerated |
| B. Day of Return <ul style="list-style-type: none">- Team member/ teacher(s) meet with student and family to review symptom status and accommodation plan | Team member | |

Post-Injury School Management Procedural Steps

In-School Programming

| Activity | Personnel | Procedures |
|--|------------------|--|
| C. Symptom progress monitoring (daily log) <ul style="list-style-type: none">- Team member periodically monitors student symptom/ exertion status, and academic progress- Emotional status assessed/ monitored- Reports progress to team, family- Adjustments to accommodation supports made according to symptom resolution | Team Member | CDC Concussion Signs & Symptom Checklist |

Post-Injury School Management Procedural Steps

In-School Programming

| Activity | Personnel | Procedures |
|--|-------------------------|---|
| D. Academic accommodations - supports continue until symptom resolution with gradual increase in demands | Team/ medical personnel | Use ACE Care Plan to communicate accommodation plan adjustments |
| E. Team liaisons with medical providers regarding progress - Adjustments made as per medical instruction | School Team member | |
| F. Symptom Resolution - Student cleared for return to full academic and athletic schedule | Medical personnel | Medical clearance documentation |

Summary

- Concussions can have a significant effect on the injured student's school learning
- School learning can potentially have a significant effect on recovery from concussion
- Understanding the unique symptom profile is critical for appropriate programming for student.
- Active, ongoing communication between medical, school team, and family is essential provide the necessary supports
- Active, regular monitoring the student's symptoms and adjusting types and intensity of supports is critically important.

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Research Staff:

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Meaghan Lancaster, and many others!



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Q&A



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SCORE



Safe Concussion Outcome,
Recovery & Education

PLAY HARD.
PLAY SAFE.
PLAY SMART!

