Managing Concussion Complexities

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Disclosure Statement

Psychological Assessment Resources, Inc.

- Test Author (royalties)
  - Behavior Rating Inventory of Executive Function (BRIEF)
  - Tasks of Executive Control (TEC)

Many other tests & measures (no royalties)

Acute Concussion Evaluation (ACE) – office, ED
ACE Care Plan; Home/School Instructions
Post-Concussion Symptom Inventory (PCSI) 5-7, 8-12, 13-18; Parent
BRIEF – Concussion Monitoring – Parent, Self-Report
Children's Exertional Effects Rating Scale (ChEERS)
Concussion Learning Assessment & School Survey (CLASS) – Parent, Self-Report
Progressive Activities of Controlled Exertion (PACE)-Self Efficacy (Child, Parent)
Multimodal Assessment of Cognition & Symptoms (MACS)
Concussion Recognition & Response (CRR) –Parent/Coach app
Concussion Assessment & Response (CARE)- Medical app

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Objectives

This session will help participants:

1. Concussion Basics
2. Concussion Complexities
   - Subtypes
   - Pre-injury hx
   - Post-injury understanding & management
3. Assessing these factors
4. Treating these factors

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Clinical Review & Education

JAMA Pediatrics | Special Communication

Centers for Disease Control and Prevention Guideline on the Diagnosis and Management of Mild Traumatic Brain Injury Among Children

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IMPORTANCE Mild traumatic brain injury (mTBI), or concussion, in children is a rapidly growing public health concern because epidemiologic data indicate a marked increase in the number of emergency department visits for mTBI over the past decade. However, no evidence-based clinical guidelines have been developed to date for diagnosing and managing

Editorial
Related article
Supplemental content

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Berlin 2016

Review

What is the difference in concussion management in children as compared to adults? a systematic review

Gavin A Davis,[1] Vicki Anderson,[1] Franz E Babl,[1] Gerard A Gioia,[2] Christopher C Giza,[3] William Meehan,[4] Rosemarie Scolaro Moser,[5] Laura Purcell,[6] Philip Schatz,[7] Kathryn J Schneider,[8] Michael Takagi,[1] Keith Owen Yeates,[9] Roger Zemek[10]

keypoi

Duration/ Prognosis

What is already known?

- The children are different from adults.
- Children may take longer to recover from spo
- Retu of children following sport-related concussion.

Assessment Tools

Active, Progressive Treatment

School Management

What are the new findings?

- Children and adolescents are expected to take up to 4 weeks to recover following sport-related concussion.
- The widespread routine use of baseline computerised neuropsychological testing is not recommended in children and adolescents.
- A brief period of cognitive and physical rest following sport-related concussion in children and adolescents should be followed with gradual symptom-limited physical and cognitive activity.
- All schools be encouraged to have a concussion prevention and management policy and should offer appropriate academic accommodations and support to students recovering from sport-related concussion.

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Cases

- Typical
- Atypical
  - Pre-Injury: Headache, Anxiety, Mood Disorder, ADHD, Learning Disability
  - Family factors
  - RRRREEESSSTTTT (Management)

CONCUSSION BASICS

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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

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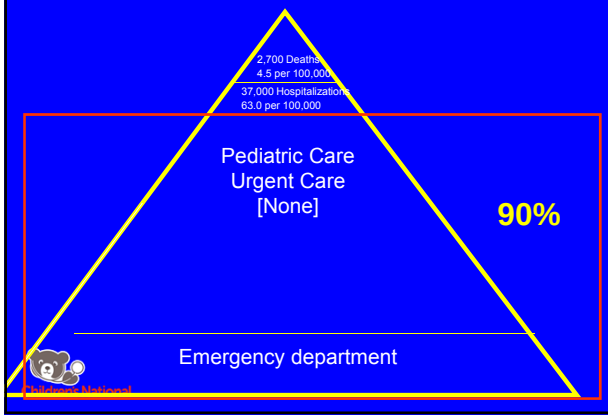
TBI in US Children



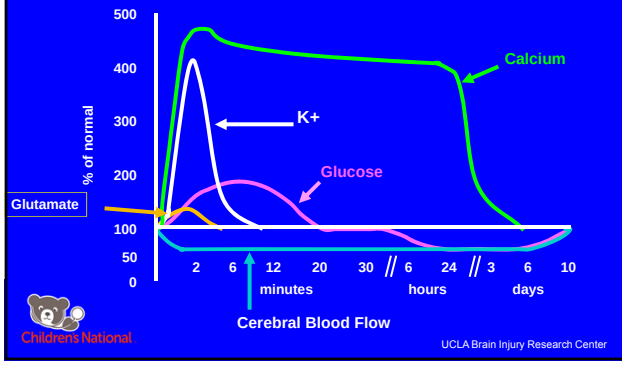
Many Causes

Motor Vehicle Collisions
Falls
Struck By/ Against
Assaults
Sports & Recreations

Concussion = Traumatic Brain Injury

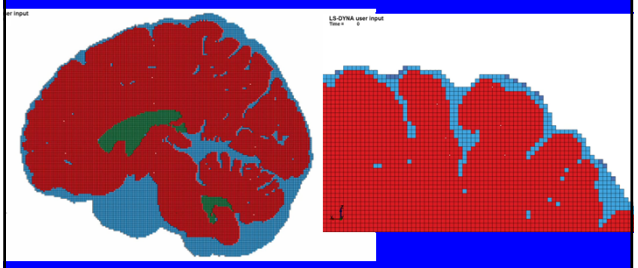
Neurometabolic Cascade Following Traumatic Brain Injury

(Giza & Hovda, 2001)



UCLA Brain Injury Research Center

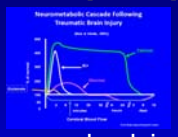
Stretch/Strain
(Brain Motion...)



Wake Forest School of Medicine

Joel Stitzel, jstitzel@wakehealth.e

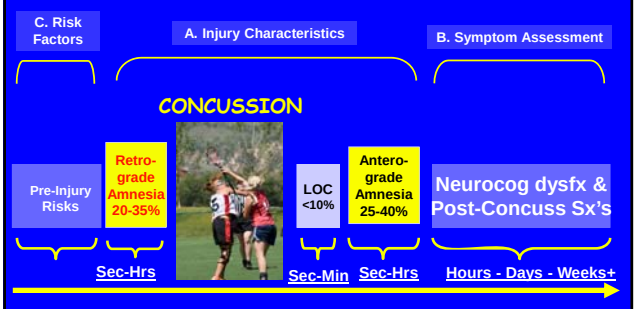
Pathophysiological Basis (2001)



- Stress and strain of force:
  - cell wall
  - diffuse axonal injury
- Massive ionic flux of potassium and calcium.
- Metabolic demands on cells exposed to ionic flux results in injury-induced diaschisis
  - loss of coupling between neuronal activation and cerebral blood flow,
  - Produces energy crisis
  - Mitochondrial dysfunction

Giza & Hovda, 2001, 2014

Anatomical Timeline of a Concussion
Defining the Key Factors



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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

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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

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And don't forget the 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

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Recovery of Child/ Adolescent: Our Best Guess

- Research literature still limited understanding of concussion recovery outcomes across full age range, and for boys and girls (IOM, 2013; CDC 2016; Berlin, 2016; NIH, 2016).
- Don't expect "7-10 days" for recovery!
- Largest pediatric-adolescent study (Zemek et al., 2016; n>3,000; age 5-18) indicates **70 +/-% symptom recovery within 4 weeks**
- And – Age, sex, injury type/severity matter!

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Who needs what treatment and when and how much (for how long)?

Injury

"Typical" Recovery (1-4 wks)
1. **Clinically Predictive Assessment**
2. **Targeted Treatment/ Rehabilitation**

Atypical Recovery (4+ wks)

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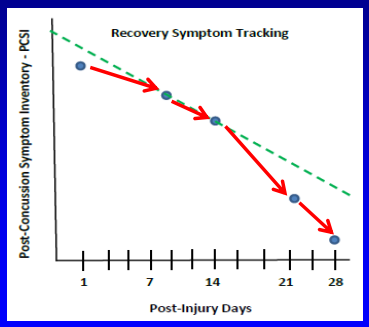
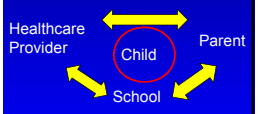
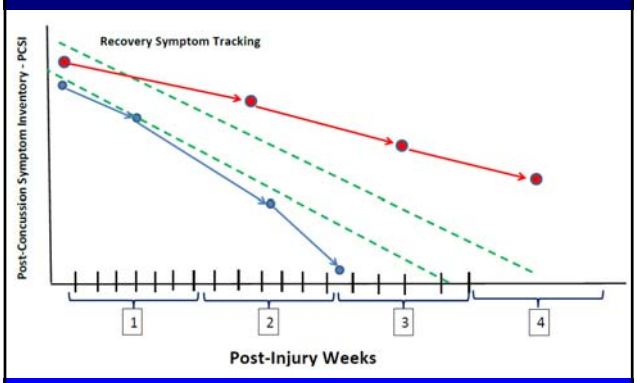
General Symptom Recovery Tracking







Concussion Complexity

Prolonged Symptom Culprits

- Headaches
- Fatigue
- Vestibular/ ocular-motor (dizziness, balance)
- Cognitive problems (attention, memory, executive function, speed)
- Anxiety/ mood problems

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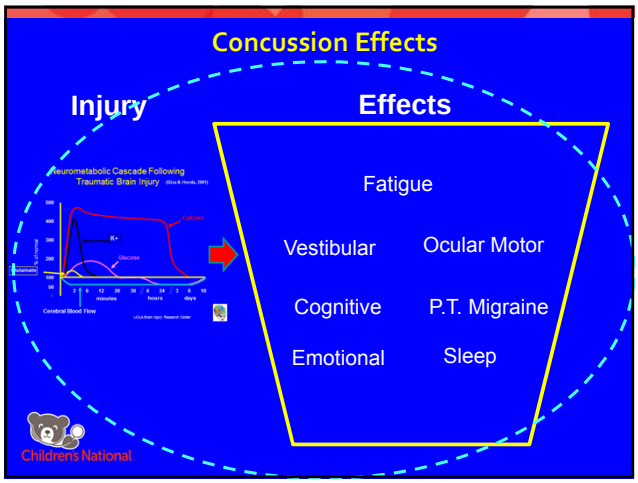
Concussion Effects
Injury
Effects
Neurometabolic Cascade Following Traumatic Brain Injury
Fatigue
Vestibular
Ocular Motor
Cognitive
P.T. Migraine
Emotional
Sleep
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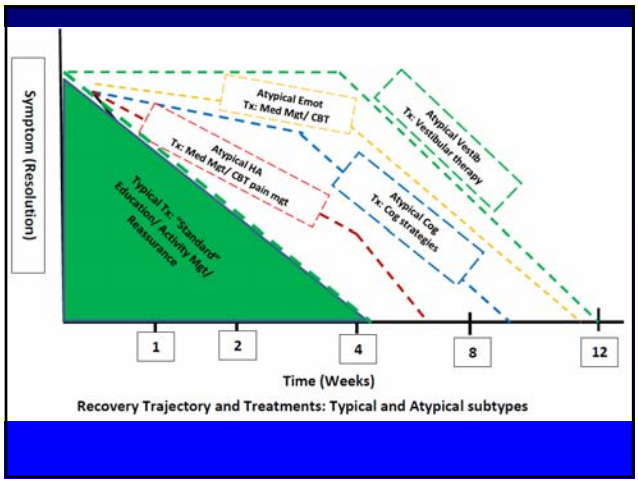
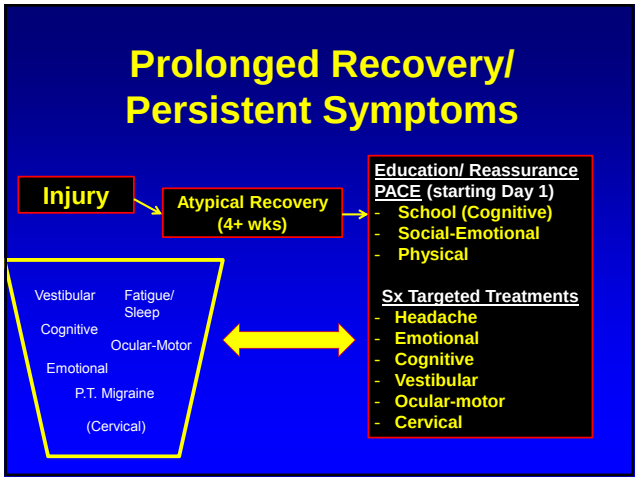
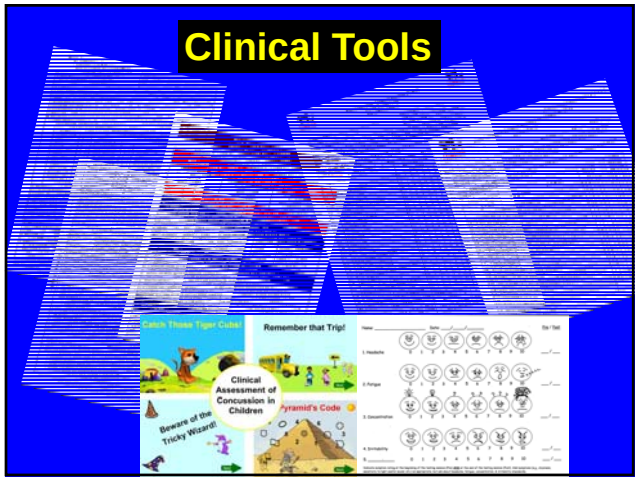
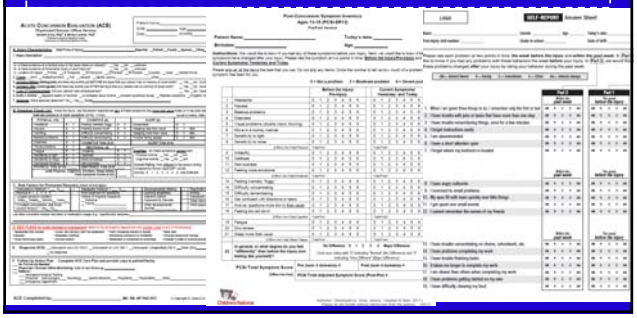

Symptom (Resolution)
Atypical Emot
Tx: Med Mgt/ CBT
Atypical Vestib
Tx: Vestibular therapy
Atypical HA
Tx: Med Mgt/ CBT pain mgt
Atypical Cog
Tx: Cog strategies
Typical Tx: "Standard"
Education/ Activity Mgt/
Reassurance
1
2
4
8
12
Time (Weeks)
Recovery Trajectory and Treatments: Typical and Atypical subtypes


Prolonged Recovery/
Persistent Symptoms
Injury
Atypical Recovery
(4+ wks)
Vestibular
Fatigue/
Sleep
Cognitive
Ocular-Motor
Emotional
P.T. Migraine
(Cervical)
Education/ Reassurance
PACE (starting Day 1)
- School (Cognitive)
- Social-Emotional
- Physical
Sx Targeted Treatments
- Headache
- Emotional
- Cognitive
- Vestibular
- Ocular-motor
- Cervical


Clinical Tools
Catch Those Tiger Cubs!
Remember that Trip!
Clinical Assessment of Concussion in Children
Beware of the Tricky Wizard!
Pyramid's Code

Symptom Assessment

Acute Concussion Evaluation (ACE) | Post-Concussion Symptom Inventory (PCSI) | Post-Concussion Executive Inventory (PCEI)



Post-Concussion Symptom Inventory (PCSI)

Child Report
- Age 5-7 – 5 items
- Age 8-12 – 17 items
- Age 13-18 – 21 items

Parent Report
- Age 5-18 – 20 items

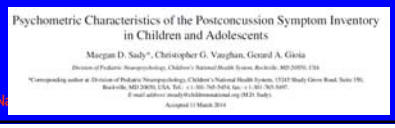
Assesses:
- 4 symptom categories
- Pre- and Post-Injury ratings to identify injury-specific effects

Developmentally sensitive

Psychometric support

Included in the NIH CDE toolkit

Used worldwide



Psychometric Characteristics of the Postconcussion Symptom Inventory in Children and Adolescents

Maegan D. Sady*, Christopher G. Vaughan, Gerard A. Gioia

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Post-Concussion Symptom Inventory
Ages 13-18 (PCSI-SR13)
RAPID Version

Patient Name:_____ Today's date:_____

Birthdate:_____ Age:_____

Instructions: We would like to know if you had any of these symptoms before your injury. Next, we would like to know if these symptoms have changed after your injury. Please rate the symptom at two points in time- **Before the Injury/Pre-Injury** and **Current Symptoms/ Yesterday and Today**.

Please answer all the items the best that you can. Do not skip any items. Circle the number to tell us how much of a problem this symptom has been for you.

0 = Not a problem 3 = Moderate problem 6 = Severe problem

		Before the Injury/ Pre-Injury	Current Symptoms/ Yesterday and Today	RAPID
1	Headache	0 1 2 3 4 5 6	0 1 2 3 4 5 6	
2	Nausea	0 1 2 3 4 5 6	0 1 2 3 4 5 6	
3	Balance problems	0 1 2 3 4 5 6	0 1 2 3 4 5 6	
4	Dizziness	0 1 2 3 4 5 6	0 1 2 3 4 5 6	
5	Visual problems (double vision, blurring)	0 1 2 3 4 5 6	0 1 2 3 4 5 6	
6	Move in a clumsy manner	0 1 2 3 4 5 6	0 1 2 3 4 5 6	
7	Sensitivity to light	[illegible]	[illegible]	
8	Sensitivity [illegible]	[illegible]	[illegible]	
9	Irritability	0 1 2 3 4 5 6	0 1 2 3 4 5 6	
10	Sadness	0 1 2 3 4 5 6	0 1 2 3 4 5 6	
11	Nervousness	0 1 2 3 4 5 6	0 1 2 3 4 5 6	
12	Feeling more emotional	0 1 2 3 4 5 6	0 1 2 3 4 5 6	
	[Office Use Only] Emotional	Total Pre=	Total Post=	

Retrospective Adjusted Post-Injury Differene (RAPID) Score
Post – Pre-Injury

Evidence-Based Post-Concussion Assessment

- Central score is the Retrospective Adjusted Post-Injury Difference (RAPID) score (Post-Pre)
- Detect change in symptoms, executive function from pre to post-injury, and across recovery.
- Guides intervention supports across recovery

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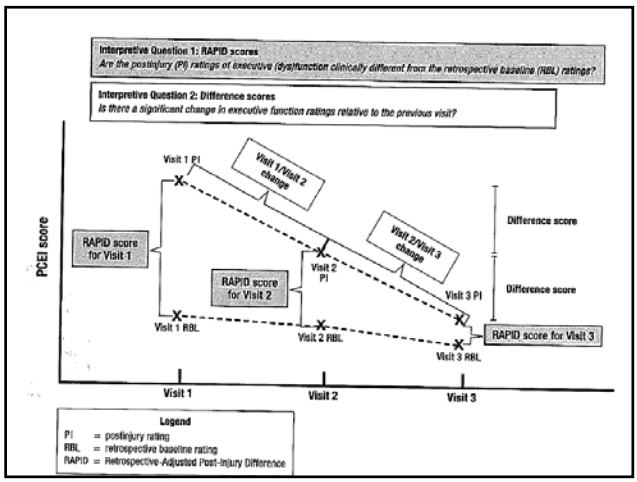

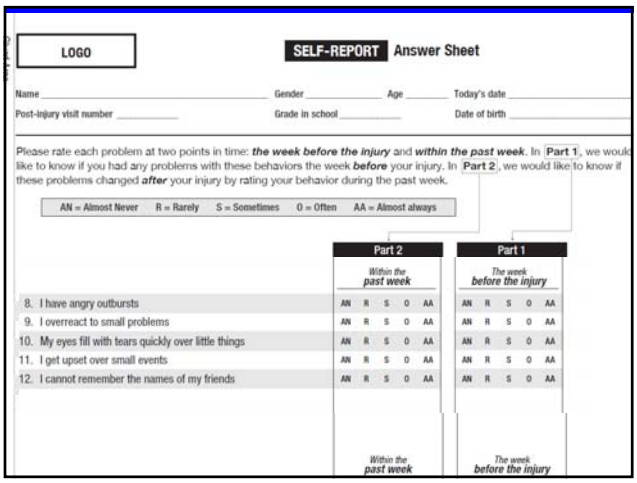

LOGO

SELF-REPORT Answer Sheet

Name _____ Gender _____ Age _____ Today's date _____

Post-injury visit number _____ Grade in school _____ Date of birth _____

Please rate each problem at two points in time: ***the week before the injury*** and ***within the past week***. In **Part 1**, we would like to know if you had any problems with these behaviors the week ***before*** your injury. In **Part 2**, we would like to know if these problems changed ***after*** your injury by rating your behavior during the past week.

AN = Almost Never R = Rarely S = Sometimes O = Often AA = Almost always

	Part 2 (Within the past week)	Part 1 (The week before the injury)
8. I have angry outbursts	AN R S O AA	AN R S O AA
9. I overreact to small problems	AN R S O AA	AN R S O AA
10. My eyes fill with tears quickly over little things	AN R S O AA	AN R S O AA
11. I get upset over small events	AN R S O AA	AN R S O AA
12. I cannot remember the names of my friends	AN R S O AA	AN R S O AA
	Within the past week	The week before the injury

RCIs applied to the Post-Concussion Executive Inventory

Score Summary Table

Visit 1				
Scale	RAPID score	*ns*	80%	90%
Working Memory	8	0-2	3	4+
Emotional Control	1	0	1	2+
Task Completion	4	0-3	4	5+
Total	13	0-6	7-8	9+

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Change over Time

Concussion recovery calculation between Visit 1 and Visit 2

Scale	RAPID score: Visit 1	–	Visit 2	=	Difference score	*ns*	80%	90%
Working Memory		–		=		0-4	5-6	7+
Emotional Control		–		=		0-2	3	4+
Task Completion		–		=		0-5	6-7	8+
Total		–		=		0-11	12-14	15+

Concussion recovery calculation between Visit 2 and Visit 3

Scale	RAPID score: Visit 2	–	Visit 3	=	Difference score	*ns*	80%	90%
Working Memory		–		=		0-4	5-6	7+
Emotional Control		–		=		0-1	2	3+
Task Completion		–		=		0-5	6-7	8+
Total		–		=		0-10	11-14	15+

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Academic Effects of Concussion in Children and Adolescents

Danielle M. Ransom, PsyD[a], Christopher G. Vaughan, PsyD[a], Lincoln Pratson, ATC[a], Meagan D. Sady, PhD[a], Catherine A. McGill, PsyD[a], Gerard A. Gioia, PhD[a]

abstract

OBJECTIVE: The aim of this work is to study the nature and extent of the adverse academic effects faced by students recovering from concussion.

METHOD: A sample of 349 students ages 5 to 18 who sustained a concussion and their parents reported academic concerns and problems (eg, symptoms interfering, diminished academic skills) on a structured school questionnaire within 4 weeks of injury. Postconcussion symptoms were measured as a marker of injury severity. Results were examined based on recovery status (recovered or actively symptomatic) and level of schooling (elementary, middle, and high school).

RESULTS: Actively symptomatic students and their parents reported higher levels of concern for the impact of concussion on school performance ($P < .05$) and more school-related problems ($P < .001$) than recovered peers and their parents. High school students who had not yet recovered reported significantly more adverse academic effects than their younger counterparts ($P < .05$). Greater severity of postconcussion symptoms was associated with more school-related problems and worse academic effects, regardless of time since injury ($P < .001$).

CONCLUSIONS: This study provides initial evidence for a concussion's impact on academic learning and performance, with more adverse effects reported by students who had not yet recovered from the injury. School-based management with targeted recommendations informed by postinjury symptoms may mitigate adverse academic effects, reduce parent and student concerns for the impact of the injury on learning and scholastic performance, and lower the risk of prolonged recovery for students with active postconcussion symptoms.

Symptoms of a Concussion

(what they feel and report)

Physical
- Headache
- Fatigue
- Visual problems (blurry/"double")
- Nausea/vomiting
- Ba
- Se
- Nu ingling

Sleep
- Sleeping more/less
- Trouble falling asleep
- Drowsiness

Cognitive
- Mental fogginess
- Difficulty conc g

Emotional
- More emotional
- Irritable
- Sad
- Nervous

Targets for Supports

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School Care Pathway

	Event	Action	Tools	Communication
1	School notified of concussion	Concussion Mgt Team (CMT) alerted	email to school staff	Internal
2	Concussion Mgt Team Notified			
	Medical/ Symptom Monitor (SM)	Obtains healthcare provide (HCP) evaluation with symptom report (medical-school handoff), expected date of return	Receives Return to School Letter	Speaks with family regarding student status, likely return plan; planned ongoing communication w HCP & family
	Academic Monitor (AM)	Coordinates with Sx Monitor to construct likely plan of accomodations/adjustments	Concussion School Support Plan (Grad RTS stage specific)	Plan reviewed with teaching team, family/ student, including progression to recovery
3	Day of Student Return	Student checks in with Sx Monitor to re-assess, make any final plan adjustments	Concussion Symptom Monitoring Log	Update teaching team if needed, scheduled sx monitoring arranged
		Academic Monitor counsels student on plan	Concussion School Support Plan (stage specific)	AM mtg with student, plan discussed
4	Periodic Monitoring			
	High symptom	Regular reassessment of symptom and Academic progress	Concussion Symptom Monitoring Log	(medical/ sx monitor assesses weekly)
	Moderate symptom Low Symptom		Acad & Sx Monitoring Tool	(teacher reports weekly)
			Concussion School Support Plan	(Acad Monitor adjusts weekly)

POST-CONCUSSION RETURN TO SCHOOL LETTER

Dear School Staff:

[Student]_____ sustained a concussion on ___[Date]_____.

Recovery typically takes between several days to several weeks. The student should return to school as soon as they can tolerate it but many students will benefit from some accommodations to their school program as they recover. As symptoms resolve and the student's learning/cognitive functioning returns to normal, s/he can gradually progress to their normal school day with reduced supports.

Current Symptoms: The student is currently reporting the following symptoms as indicated by the (√) below. These can be viewed as targets for supportive classroom accommodations to assist a successful return. See suggested supports for these symptoms on page 2.

PHYSICAL		COGNITIVE	EMOTIONAL
☐ Headaches	☐ Fatigue	☐ Feeling mentally foggy	☐ Irritability
☐ Sensitivity to light	☐ Sensitivity to noise	☐ Memory problems	☐ Anxiety/ nervousness
☐ Blurry/double vision	☐ Nausea/ vomiting	☐ Slowed thinking/ performance	☐ Sadness
☐ Balance Problems	☐ Dizziness	☐ Difficulty concentrating	☐ Feeling more emotional

Return to School: The student can return to school when:
(1) S/he can concentrate on school work for 30 minutes before symptoms worsen significantly.
(2) Symptom exacerbation reduces/resolves with cognitive rest breaks, allowing return to activity.

Based on the current symptoms, he/she is ___*permitted to return to school.*
___ *is excused for* ____ *days*

Safety Restriction: To reduce risk for re-injury, there should be
* No physical (risk) activity during recess *No Physical Education (Gym) class
* No sports participation *Other:_____

Physical Activity: Mild-moderate symptom-limited exercise (walking) daily is permitted.

Health Care Provider Signature _____ Date_____

Contact Information_____

Healthcare Provider Input
- **Diagnose**
- **(Re)Define**
- **Recommend/Suggest**

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ACE Post-Concussion Gradual Return to School (RTS) Guide

Use of the Gradual Return to School Guide: Every student's recovery from concussion is different. The 5 progressive stages are meant to give the medical provider and school team general guidance to assisting the student's gradual return. The stages are not to be viewed as absolute for every student to progress through if their symptoms do not warrant it. What is important is to strike a balance between providing the student with the necessary supports for symptom relief while progressing to their normal school schedule. Students with faster recoveries may skip a stage or two. Use of the Symptom Targeted Accommodation & Management Plan should accompany this guide.

Stage	Description	Level of Activity	Criteria to Move to Next Stage
0	No return, at home (recommend 1-3 days for most students)	Day 1 - Maintain low level cognitive and physical activity. No prolonged concentration. Cognitive Readiness Challenge: As symptoms improve, try reading or math challenge task for 10-30 minutes; assess for symptom increase.	To Move To Stage 1: (1) Student can concentrate on school work for 30 minutes before symptoms worsen significantly. AND (2) Symptoms reduce or disappear with cognitive rest breaks allowing return to activity.
1	Return to School, Partial Day (1-3 hours)	- Attend 1-3 classes, intersperse rest breaks. - No tests or homework. - Expectations for productivity: minimal	To Move To Stage 2: Symptom status improving, tolerates 4-5 hours of activity-rest cycles; 2-3 cognitive rest breaks built into school day.
2	Full Day, Maximal Supports (required throughout day)	- Attend most classes, with 2-3 rest breaks (20-30'), no tests. - Minimal HW (≤ 60'). - Expectations for productivity: Minimal – moderate	To Move To Stage 3: Symptom number & severity improving, needs 1-2 cognitive rest breaks built into school day.
3	Return to Full Day, Moderate Supports (provided in response to symptoms during day)	- Attend all classes with 1-2 rest breaks (20-30') – - Begin quizzes. - Moderate HW (60-90') - Expectations for productivity: Moderate - Design schedule for make-up learning/work	To Move To Stage 4: Continued symptom improvement, needs no more than 1 cognitive rest break per day
4	Return to Full Day, Minimal Supports (Monitor final recovery)	- Attend all classes with 0-1 rest breaks (20-30'); - Begin modified tests (breaks, extra time). - HW (90+') - Expectations for productivity: Moderate-maximum	To Move To Stage 5: No active symptoms, no exertional effects across the full school day.
5	Full Return, No Supports Needed	- Full class schedule, no rest breaks. - Expectations for productivity: Maximum - Begin to address make-up learning/ work	N/A

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Symptom Targeted Academic Management Plan (STAMP)

Below, please see the symptoms they are currently experiencing. To promote recovery, the student will be provided with the following classroom accommodations that support their academic learning and performance:

Symptom (check)	Functional school problem	Accommodation/ management strategy (select)
Cognitive Symptoms		
Attention & concentration difficulties	Short focus on lecture, classwork, homework	Shorter assignments (fewer/less problems, reading outside or blank points instead of full written responses) __ Break down tasks and tests into chunks/segments Lighter work load. Max. nightly homework (including studying): ___ min
Working memory (short-term memory)	Trouble holding instructions, lecture, reading material, thoughts in mind	__ Repetition __ Written instructions
Memory consolidation/ retrieval	Accessing learned information	__ Provide student with teacher generated class notes __ Smaller chunks/segments to learn, repetition __ Recognition cues
Processing speed		
Cognitive Fatigue/ Fogginess		
Physical Symptoms		
Headaches	Interferes with concentration Increased irritability	__ Intersperse rest breaks, shortened day if symptom does not subside __ Allow for short naps in quiet location (e.g., nurse's office)
Light/ noise sensitivity	Symptoms worsen in bright or loud environments	__ Wear sunglasses/hat, seating away from bright sunlight __ Limit exposure to SMART board, computers, provide class notes __ Avoid noisy/crowded environments such as lunchroom, assemblies, chorus/music class, and hallways. Leave class early. __ Allow student to wear earplugs as needed
Dizziness/ balance/ nausea	Unsteadiness when walking Nausea or vomiting	__ Elevator pass __ Class transition before bell
Sleep disturbance	Decreased arousal, shifted sleep schedule, trouble falling asleep	__ Later start time __ Shortened day or rest breaks
Fatigue	Lack of energy	__ Periodic rest breaks, short naps in quiet location __ Passive participation

Targets for Student Support and Treatment

Guiding Progressive Activities of Controlled Exertion

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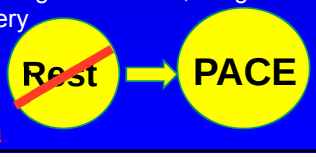
Active Recovery Management
(Typical Recovery: 1-4 weeks)

Injury → **"Typical" Recovery (1-4 wks)** → **Education/ Reassurance**
PACE (starting Day 1)
- **School (Cognitive)**
- **Social-Emotional**
- **Physical**

Setting the Positive Foundation: Key Messages
- You will get better.
- You will improve and recover.
- You have control of your activity.
- Your efforts to control your activity & time will pay off.
- Find your "sweet spot" of activity (not too little/much).

Progressive Activities of Controlled Exertion (PACE)*

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



*Gioia, 2015

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"Active" Aerobic Rehabilitation

- Aerobic Activation (Gagnon et al., 2009; Leddy et al, 2010)
- Structured and monitored subsymptom threshold exercise to facilitate healing.
- Progressive "controlled" exercise below level that produces symptom occurrence or worsening.

Active rehabilitation for children who are slow to recover following sport-related concussion

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Abstract

"Active" Aerobic Rehabilitation

A Preliminary Study of Subsymptom Threshold Exercise Training for Refractory Post-Concussion Syndrome

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Objective: To evaluate the safety and effectiveness of subsymptom threshold exercise training for the treatment of post-concussion

Conclusions: Treatment with controlled exercise is a safe program that appears to improve PCS symptoms when compared with a no-treatment baseline. A randomized controlled study is warranted.

"Treatment with controlled exercise is a safe program that appears to improve PCS symptoms when compared with a no-treatment baseline."

Intervention: Treadmill test to symptom exacerbation threshold (ST) before and after 2 to 3 weeks of baseline. Subjects then exercised 5 to 6 days per week at 80% ST heart rate (HR) until voluntary peak exertion without symptom exacerbation. Treadmill testing was repeated every 3 weeks.

Main Outcome Measures: Adverse reactions to exercise, PCS symptoms, HR, systolic blood pressure (SBP), achievement of maximal exertion, and return to work/sport.

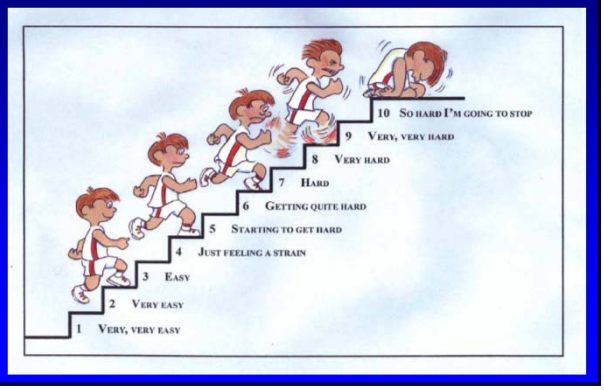
Results: Pretreatment, ST occurred at low exercise HR (147 ± 27 bpm) and SBP (142 ± 6 mm Hg). After treatment, subjects exercised longer (9.75 ± 6.38 minutes to 18.67 ± 2.53 minutes, $P = .001$) and achieved peak HR (179 ± 17 bpm) and SBP (156 ± 13 mm Hg), both $P < .001$ versus pretreatment, without symptom exacerbation. Time series analysis showed significant change in rate

INTRODUCTION

The majority of patients with sport-related concussion recover within 7 to 10 days[1] and nonathletes within the first 3 months.[2] There is, however, a significant minority of athlete[3] and nonathlete[4] patients who continue to experience symptoms beyond this, called post-concussion syndrome (PCS). The World Health Organization defines PCS as persistence of 3 or more of the following after head injury: headache, dizziness, fatigue, irritability, insomnia, concentration difficulty, or memory difficulty.[5] The primary forms of PCS treatment have traditionally included rest, education, neurocognitive rehabilitation, and antidepressants, with little evidence of success.[5]

Concussion affects not only cognitive function but also other physiological systems to include the heart and the autonomic nervous system.[6–8] Concussed athletes have exaggerated sympathetic nervous activity and increased heart rates

Pictorial Children's Effort Rating Table (PCERT)



Promoting Health/ Reducing Risk in Sports

Health Promotion

Sleep

Stress Management

Physical Activity

Eat Well

Relate!

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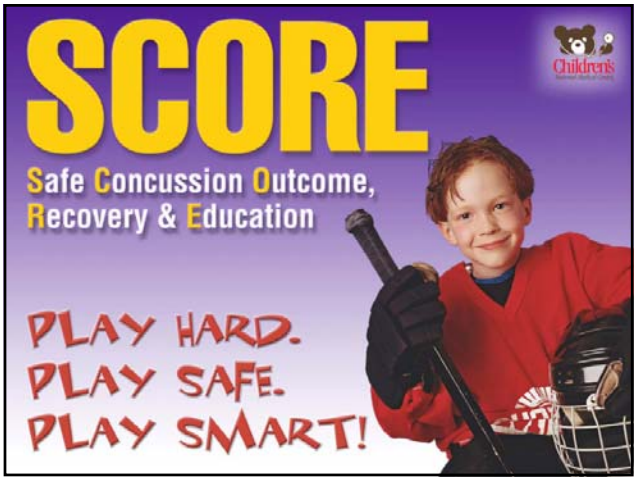
Cases

- Typical
- Atypical
  - Pre-Injury: Headache, Anxiety, Mood Disorder, ADHD, Learning Disability
  - Family factors
  - RRRREEESSSTTTT (Management)



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