How Much Rest is Best in Sports Concussion?

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Disclosures

- None
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Take-home points: Active recovery for concussion

- Majority of adults recover in 2 weeks; kids 4 weeks
- 24-48 hrs of symptom-limited physical and cognitive rest then gradual increase activity, avoiding symptom exacerbation
- Identify and treat concussion phenotype
- Gradual return to learn / work with accommodations
- Gradual return to physical activity with accommodations or rehab
- Return to full (contact) play once asymptomatic
Concussion definition

- mTBI: mild traumatic brain injury
- Blow to head, neck, body → neurological symptoms within 48 hours
- CT and MRI normal
- May or may not include loss of consciousness
- Cannot be explained by drug, alcohol, medication use, or other injuries or comorbidities

Concussion pathophysiology

Force to brain, axonal stretching → Ion fluxes; vasoconstriction → Need glucose but less blood flow → Energy crisis

Concussion recovery

- Typical time to resolve
  - Adults: 10-14 days
  - Kids: Up to 4 weeks
- CDC recommendation:
  - Counsel patients and families that most patients with concussion do not have significant difficulties that last more than 1-3 months post injury.

Each of the following factors has been associated with longer recovery from concussion except for which?

A. Loss of consciousness at time of injury
B. Higher initial symptom burden
C. History of neurological disorder
D. History of psychiatric disorder
E. Learning difficulties
F. Family and social stressors

Why cognitive rest?

- Concussion = energy crisis in the brain that needs rest to recover
- Animal studies: starting physical activity immediately post TBI delays cognitive recovery  
  (Griesbach GS et al. Brain Res 2004.)
- Kids who returned to school early post concussion have been shown to have prolonged recovery  
  (Brown NJ et al. Pediatrics. 2014.)
- Cognitive rest post injury → faster recovery times  
  (Taubman B et al. Child Neurol. 2016.)
History of rest until symptom-free

- Derived from sports literature
- 2nd head injury prior to resolution of 1st could lead to catastrophic brain injury (evidence: animal models and second impact syndrome)
- Return to physical activity within 7-10 days associated with high risk of repeat concussion in NCAA football players (Guskiewicz KM et al. JAMA 2003.)
But too much rest may be harmful

- Concussion patients age 11-22 who rested 2 days vs 5 days: those with longer rest period had more symptoms and slower resolution of symptoms (Thomas DG et al. Pediatrics. 2015.)
- Removing a child from school for extended time may cause anxiety about returning to school (Ponsford J et al. Neuropsychology. 2012.)
- In concussion patients age 13-18 randomized to stretching vs progressive subsymptom threshold aerobic exercise 5 days post injury, those who did aerobic exercise recovered 4 days faster (13 days vs 17 days, p=0.009) (Leddy JJ et al. Jama Pediatrics. 2019.)
Berlin consensus 2017 on rest

- “There is currently insufficient evidence that prescribing complete rest achieves these objectives.” (those of mitigating symptoms and/or promoting recovery by minimizing brain energy demands post concussion)
- “After a brief period of rest …24-48 hours after injury, patients can be encouraged to become gradually and progressively more active while staying below their cognitive and physical symptom-exacerbation thresholds…”
- “The exact amount and duration of rest is not yet well defined in the literature and requires further study.”

How much rest after concussion?

1-2 days

Concussion care 2019: Active recovery

- Gradual progression back to regular activity as tolerated
- 2-point rule
  - Ok to gradually return back to cognitive and noncontact physical activity as long as the activity does not make symptoms worse by 2 points (on a 10-point scale)*
- History and physical exam can help form recovery plan
Case #1

- 27 y/o software engineer presenting with concussion.
- 5 days ago fell while skiing, helmeted. No LOC but immediate headache.
- Friends took her to local ED, no head CT needed. Advised to rest and to follow up the following week in primary care.
- Has not returned to work or exercise.
- Mild-moderate headache is worse with bright light and screens. Feels foggy and tired.
- Medications: none
- PMHx: none (incl no h/o concussion, HA, ADHD, psych)
- SHx: work is understanding of her injury. No drug use. 1-2 alcoholic beverages/week.
Purpose of concussion evaluation

1. Rule out
   1. Intracranial hemorrhage
   2. Cervical injury
2. Determine
   1. Risk factors for longer recovery
   2. Symptoms
   3. Systems affected
Systems affected by concussion

Adapted with permission from slide by Matthew Grady, MD
Self-reported symptom assessment

<table>
<thead>
<tr>
<th>Symptom</th>
<th>None</th>
<th>Mild</th>
<th>Moderate</th>
<th>Severe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Headache</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>&quot;Pressure in head&quot;</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Neck pain</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Nausea/Vomiting</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Dizziness</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Blurred vision</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Balance problems</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Sensitivity to light</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Sensitivity to noise</td>
<td>0</td>
<td>1</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>Feeling slowed down</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Feeling &quot;in a fog&quot;</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Symptom</th>
<th>None</th>
<th>Mild</th>
<th>Moderate</th>
<th>Severe</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;Don't feel right&quot;</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Difficulty concentrating</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Difficulty remembering</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Fatigue/Low energy</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Confusion</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Drowsiness</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>More emotional</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Irritability</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Sadness</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Nervous/Anxious</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Trouble falling asleep</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>4</td>
</tr>
</tbody>
</table>

Symptom severity score = 46
Clusters: headache, emotional
Autonomic Headache
Light, noise sensitivity
Exercise intolerance
Fatigue
Dizziness

Cognitive Headache
Foggy
Slowed down
Confusion

Vestibulo-ocular Headache
Nausea
Fatigue
Dizziness
Balance
Blurred vision

Emotional
Irritable
Nervous
Sad
Concussion physical exam

- **Goal:** identify the system injured as source of symptoms to help guide rehab
- **Autonomic dysfunction**
  - Orthostatic vital signs
  - Elevated resting HR
  - Large but reactive pupils
- **Vestibulo-ocular dysfunction**
  - Eye tracking problems
  - Balance problems

Vestibulo-ocular motor screening (VOMS)

- **Horizontal saccades**
  - Crucial in reading for visual processing of written text

- **Vertical saccades**
  - Crucial in visual processing when copying notes from board or from computer screen

- **Near point convergence**
  - Crucial in transitioning from taking notes, seeing far then near and sustaining focus at near (reading small print)

Balance Error Scoring System: BESS
Autonomic

Orthostatic vital signs
Elevated resting heart rate
Large but reactive pupils

School / work: frequent breaks, 2-point rule, avoid or limit testing initially, allow use of sunglasses and/or ear plugs. Allow light aerobic activity (2-point rule)
(PT for graduated exercise protocol)
(Medication)

Adapted with permission from slides by Matthew Grady, MD
Progressive subsymptom threshold aerobic activity post concussion

- Exercise intolerance post concussion appears to reflect impaired autonomic function
- Exercise improves autonomic nervous system function
- Emerging data suggests that subsymptom threshold aerobic activity may expedite recovery from acute concussion

Using the Buffalo concussion treadmill test to guide rehab

- Incremental treadmill exercise test
- Start 3.3 mph 0% incline
- After 1 min increase to 2% incline
- At minute 3 and each minute thereafter increase incline by 1%
- Check RPE every minute, BP and HR every 2 minutes
- Stop at report of exacerbation of concussion symptoms
- Ex Rx: perform once/day aerobic exercise for same duration achieved during the treadmill test but at 80% intensity of max HR achieved during treadmill test. Stop early if symptom exacerbation.

Vestibulo-ocular

Symptoms with:
- Vertical saccades
- Horizontal saccades
- Near point convergence

Abnormal balance

Vertical saccade deficit: avoid note-taking, use pre-printed notes

Horizontal saccade deficit: use larger font, audio books

Convergence deficit: larger font, audio lectures/books

Vestibular + balance exercises either at home or with PT

Adapted with permission from slides by Matthew Grady, MD
Cognitive Symptom report Mental status evaluation (SAC, MMSE)

Rehab = gradual return to work or school
2 point rule
Accommodations based on other deficits (Medication)

Adapted with permission from slides by Matthew Grady, MD
Emotional Symptoms
+/- PHQ9
+/- GAD7

Clear plan for return to school / work
Empathy (CBT)
(Medication)

Adapted with permission from slides by Matthew Grady, MD
Case #1

27 y/o woman 5 days s/p fall while skiing with concussion. Software engineer. Has been off work since injury.

- Symptom severity score moderately high (46)
- Clustering in headache, light sensitivity, mood
- Vital signs normal
- Neck exam normal
- Neurological exam non-focal
- Headache and head pressure increased with horizontal and vertical saccades
- Near point convergence < 10 cm
How would you treat this patient?

A. Order urgent head CT to rule out subtle post traumatic bleed, return to clinic after CT.

B. Order brain MRI to evaluate for post traumatic microhemorrhage, return to clinic after MRI.

C. Give advice on gradual return to cognitive and physical activity now (no contact sports), follow up 1 week.

D. Rest from cognitive and physical activity until symptom free, follow up 1 week.
Return to learn / work progression

No school / work. OK to do light reading, little bit TV, drawing, cooking as long as doesn’t worsen symptoms.

15 min cognitive activity at a time.

30 min cognitive work at a time until can do 1-2 hours.

Return to ½ day of work / school.

Return to full day of school.

http://www.chop.edu/service/concussion-care-for-kids/returning-to-school.html
- Concussion Information Sheet
- Acute Concussion Notification Form
- Graded Concussion Symptom Checklist
- Physician Letter to School After Concussion Visit
- Concussion Return to Learn (RTL) Protocol
- Physician Recommended School Accommodations Following Concussion
- Concussion Return to Play (RTP) Protocol

www.cifstate.org/sports-medicine/concussions/index
**CIF: Return to Learn protocol**


**Instructions:**
- Keep brain activity below the level that causes worsening of symptoms (e.g., headache, tiredness, irritability).
- If symptoms worsen at any stage, stop activity and rest.
- Seek further medical attention if your child continues with symptoms beyond 7 days.
- If appropriate time is allowed to ensure adequate brain recovery before progressing mental activity, your child may have a better outcome (do not try to rush through these stages).
- Please give this form to teachers/school administrators to help them understand your child’s recovery.

<table>
<thead>
<tr>
<th>Return to School - PARTIAL DAY</th>
<th>Return to School - FULL DAY</th>
<th>Progress to the next stage when your child can complete the above activities without symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allow 8-10 hours of sleep per night</td>
<td>Allow 8-10 hours of sleep per night</td>
<td>Progress to attending core classes for full days of school</td>
</tr>
<tr>
<td>Limit napping to allow for full sleep at night</td>
<td>Avoid napping</td>
<td>Progress physical activity and as instructed by physician</td>
</tr>
<tr>
<td>Drink lots of fluids and eat healthy foods every 3-4 hours</td>
<td>Drink lots of fluids and eat healthy foods every 3-4 hours</td>
<td>No strenuous physical activity or contact sports</td>
</tr>
<tr>
<td>Screen time* less than 1 hour a day</td>
<td>Screen time* and social activities outside of school as tolerated</td>
<td>No driving</td>
</tr>
<tr>
<td>Limit social time outside of school</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Screen time* is defined as time spent on screens such as TV, computer, or phone.

Progress to the next stage when your child has returned to full school and is able to complete all assignments/tests without symptoms:
Daily activities that don’t provoke symptoms

After 24-48 hours

Light aerobic activity

BCTT? Subthreshold Aerobic activity?

Sport specific activity

Non contact training

Full contact practice

Game play

Per AB 27 this RTP protocol must last at least 7 days.
Take-home points: Active recovery for concussion

- Majority of adults recover in 2 weeks; kids 4 weeks
- 24-48 hrs of symptom-limited physical and cognitive rest then gradual increase activity, avoiding symptom exacerbation
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- Gradual return to learn / work with accommodations
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Concussion resources

- UCSF Sports Concussion Program: concussion@ucsf.edu
- California Interscholastic Federation http://www.cifstate.org/sports-medicine/concussions/index
- CDC Pediatric mTBI Guidelines: https://www.cdc.gov/traumaticbraininjury/PediatricmTBIGuideline.html.
Thank you!

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