Return to Play after Concussion: Youth vs. Professional Protocols

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Disclosures

I have no personal financial or other relationships, conditions, and/or circumstances that present potential conflicts of interest.
Definition/Diagnosis

**Functional Injury**

- **Concussion** is a disturbance in brain function caused by a direct or indirect force to the head. It results in a variety of non-specific signs and/or symptoms.
- Rotational mechanism
- Concussion should be suspected and the appropriate management strategy instituted in the presence of any one or more of the following:
  - Symptoms somatic (e.g., headache), cognitive (e.g., feeling like in a fog) and/or emotional
  - Physical signs (e.g., unsteadiness)
  - Cognitive Impairment (e.g. confusion, slowed reaction times)
  - Abnormal behavior (e.g., change in personality, irritability)
  - Sleep disturbance (e.g. insomnia)

Pathophysiology

• Cellular level - Flood of neurotransmitters from trauma
• Ion flux
  (efflux of K+, influx of Ca+)
• Depolarization – spreading depression
• Intracellular Glucose delivery interrupted
  Decreased flow with increased demand
• Creates metabolic dysfunction and cell vulnerability leading to symptoms
  “Energy Crisis”
Pathophysiology

Neurometabolic Cascade Following Cerebral Concussion/mTBI
Phased Management

1. Aggressive Rest*
2. Return to Learn
3. Return to Activity
4. Return to Play
Return to Play

- Resolution of symptoms at rest
- Academic tolerance
- Exercise tolerance
- Neurocognitive test results
RTP History – Original Cantu 1980s

- Allowed RTP same day of injury if the athlete was symptom-free both at rest and following physical exertion.
- Any loss of consciousness, a restriction of contact for 1 month.
- Athletes who had suffered a grade 2 concussion were allowed to return to play in 2 weeks if asymptomatic for a period of 7 days.

<table>
<thead>
<tr>
<th>Guideline</th>
<th>Grade 1</th>
<th>Grade 2</th>
<th>Grade 3</th>
</tr>
</thead>
</table>
## RTP History – Colorado Guidelines 1991

<table>
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<tr>
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<tbody>
<tr>
<td></td>
<td>2. No loss of consciousness</td>
<td>2. No loss of consciousness</td>
<td></td>
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</tbody>
</table>

- Allowed for same-day RTP if symptoms cleared within 20 minutes of injury.
- For more severe injury, the guidelines recommended immediate transport to a hospital for further evaluation.
RTP History – AAN Colorado Revision

- Allowed RTP the same day of injury if the athlete’s signs and symptoms cleared within 15 minutes of injury.
- Grade 2 concussion was managed in a manner similar to the original Colorado guidelines, with return to competition within 1 week if asymptomatic
RTP History – Cantu Revision 2001

• Same-day RTP was allowed only if the athlete was completely asymptomatic following the injury

RTP History

• AOSSM – late 90s
• FIFA/IOC CISG – 2001/2002 Vienna first consensus statement to most recent Berlin 2016/2017
  • (planned update before Dec 31 2020)
RTP Physiologic Basis

- Gray matter has been shown to increase in the brain during childhood but then reaches a peak in adolescence, plateaus, and decreases through adulthood.
- During adolescence, the brain undergoes a structural reorganization in which white matter increases and gray matter peaks.
- These changes in brain development may result in increases in reported cognitive deficiencies.
RTP Physiologic Basis

- The immature brain may be up to 60 times more sensitive to glutamate
  - Neurotransmitter involved in the metabolic cascade following concussion

RTP Physiologic Basis

**High school** football athletes reported the highest number of symptoms and the *longest return-to-play time*


• Child athletes take longer to recover from concussions than adults.

• Concussion symptoms may resolve before cognitive function has completely recovered.
# RTP Physiologic Basis

**Table 4. Return-to-Play Time for Athletes With Concussions in Youth, High School, and College Football, 2012 to 2014 Seasons**

<table>
<thead>
<tr>
<th>Return-to-Play Time&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Level of Competition, No. (%)</th>
<th>Pro MLB</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Youth</td>
<td>High School</td>
</tr>
<tr>
<td>Less than 24 h</td>
<td>8 (10.1)</td>
<td>7 (0.8)</td>
</tr>
<tr>
<td>1 to 6 d</td>
<td>52 (25.2)</td>
<td>86 (10.4)</td>
</tr>
<tr>
<td>7 to 13 d</td>
<td>59 (33.2)</td>
<td>294 (35.4)</td>
</tr>
<tr>
<td>14 to 29 d</td>
<td>20 (11.2)</td>
<td>281 (33.9)</td>
</tr>
<tr>
<td>At least 30 d</td>
<td>29 (16.3)</td>
<td>162 (19.5)</td>
</tr>
<tr>
<td>Missing</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Total</td>
<td>178 (100.0)</td>
<td>830 (100.0)</td>
</tr>
</tbody>
</table>

<sup>a</sup> Missing data are not included in calculations of percentages. Data originate from the Youth Football Surveillance System for youth; National Athletic Treatment, Injury, and Outcomes Network for high school; and National Collegiate Athletic Association Injury Surveillance Program for college, 2012 to 2014 seasons.

RTP Physiologic Basis

Should we be keeping our youth athletes out longer?
<table>
<thead>
<tr>
<th>Stage</th>
<th>Aim</th>
<th>Activity</th>
<th>Goal of each step</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Symptom-limited activity</td>
<td>Daily activities that do not provoke symptoms</td>
<td>Gradual reintroduction of work/school activities</td>
</tr>
<tr>
<td>2</td>
<td>Light aerobic exercise</td>
<td>Walking or stationary cycling at slow to medium pace. No resistance training</td>
<td>Increase heart rate</td>
</tr>
<tr>
<td>3</td>
<td>Sport-specific exercise</td>
<td>Running or skating drills. No head impact activities</td>
<td>Add movement</td>
</tr>
<tr>
<td>4</td>
<td>Non-contact training drills</td>
<td>Harder training drills, eg. passing drills. May start progressive resistance training</td>
<td>Exercise, coordination and increased thinking</td>
</tr>
<tr>
<td>5</td>
<td>Full contact practice</td>
<td>Following medical clearance, participate in normal training activities</td>
<td>Restore confidence and assess functional skills by coaching staff</td>
</tr>
<tr>
<td>6</td>
<td>Return to sport</td>
<td>Normal game play</td>
<td></td>
</tr>
</tbody>
</table>

- **NOTE:** An initial period of 24–48 hours of both relative physical rest and cognitive rest is recommended before beginning the RTS progression.

- There should be at least 24 hours (or longer) for each step of the progression. If any symptoms worsen during exercise, the athlete should go back to the previous step. Resistance training should be added only in the later stages (stage 3 or 4 at the earliest). If symptoms are persistent (eg. more than 10–14 days in adults or more than 1 month in children), the athlete should be referred to a healthcare professional who is an expert in the management of concussion.
RTP Professional and Collegiate Athlete

- All athletes, regardless of level of participation, should be managed using the same management principles noted in the previous protocol.

RTP Youth Athlete

- RTP decisions in children should be made cautiously and should be individualized
- Youth athletes should remain symptom free for several days (*Double the Duration*) before starting a medically supervised stepwise exertion protocol
Prevention

HANS Device

Periscapular and Postural (Neck) Stabilization

Fair Play and Age/Skill/Size matching

No evidence for helmet brand/type, mouth-guards
Thank you

Questions?