No Tolerance for Exercise Intolerance: Prescribing Exercise After Sport Related Concussion

Emily M. Kosderka PhD, ATC
Assistant Professor of Health & Human Performance
Linfield University
No disclosures...
Objectives

• Define exercise Intolerance
• Review the rationale & recommendations for inclusion of exercise in the management of concussion
• Examine the existing research on frequency, intensity, time, type, and timing of exercise
• Demonstrate how existing evidence can be translated into clinical practice
A Paradigm Shift...

http://www.naturalawakenings.com/Health-Briefs-Archive/Silence-De-Stresses-the-Brain/

https://maymassage.info/thong-tin-can-biet-ve-xe-dap-tap-the-duc-reebok-z7-ra1-11710/
How did this happen?/Why the change?

• Little to no evidence that rest was beneficial to recovery
• Improved understanding of the physiological nature of concussion & its affect on the Autonomic Nervous System (ANS)
The Pathophysiological Rationale (abbreviated)

- Altered ANS function (Leddy & Willer, 2013)
- Disruption or dysregulation of CBF = metabolic disequilibrium & energy crisis (Giza & Hovda, 2001; Leddy & Willer, 2013)
- And how exercise...
- Aides in restoration of CBF regulation (Clausen et al., 2016; Leddy et al., 2013)
- Assists with neuronal repair through increasing BDNF (Griesbach et al., 2012)
- Assists with “retraining” the ANS (Kozlowski, 2014)
Exercise Intolerance

• Definition: Reduced ability to be physically active/exercise at the expected level according to age and physical condition due to exacerbation of symptoms (Valaas et al., 2023)

• Results from damage to the ANS interfering with CBF

• Physiological biomarker of SRC

• Can be assessed through testing (BCTT & BCBT)
"After a brief period of initial rest (24–48 hours), symptom-limited activity can be begun while staying below a cognitive and physical exacerbation threshold." (McCrory et al., 2017)

"HCPs with access to exercise testing can safely prescribe subsymptom threshold aerobic exercise treatment within 2–10 days after SRC..." (Patricios et al., 2023)
The FITT Principle

* Frequency
* Intensity
* Time
* Type
* Timing  (Lawrence et al., 2018)
**Timing** - when should patients begin exercising after injury?

- 24-48 hours of rest recommended
- Determine status of the patient - how are they doing?
- Early studies investigated exercise intervention with mostly PCS patients & demonstrated it to be safe (Gagnon et al. 2009; Leddy et al. 2010, Baker et al. 2012)
- More recent studies have been moving the timeline back closer to the date of injury
- 2-10 days (Patricios et al. 2023)

<table>
<thead>
<tr>
<th>Author (year)</th>
<th>Time following injury</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gagnon et al., 2009</td>
<td>4-18 weeks</td>
</tr>
<tr>
<td>Leddy et al., 2010</td>
<td>6-40 weeks</td>
</tr>
<tr>
<td>Baker et al., 2012</td>
<td>8-40 weeks</td>
</tr>
<tr>
<td>Maerlender et al., 2015</td>
<td>“recently concussed”</td>
</tr>
<tr>
<td>Lawrence et al., 2018</td>
<td>1-10 days</td>
</tr>
<tr>
<td>Micay et al., 2018</td>
<td>6 days</td>
</tr>
<tr>
<td>Leddy et al., 2019</td>
<td>&lt;10 days (mean 5 days)</td>
</tr>
<tr>
<td>Popovich et al., 2019</td>
<td>&lt;16 days vs &gt;16 days</td>
</tr>
</tbody>
</table>
Mode—what type of exercise should they perform?

- Aerobic
- Relatively universal using either a stationary bike or treadmill
- Popovich et al., (2019) include med balls, agility drills, & sport specific exercises
- Resistance exercise (weight lifting) not recommended (Worts et al., 2019)
### Intensity - At what intensity level should patients exercise?

<table>
<thead>
<tr>
<th>Intensity</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stationary bike; elliptical; running; med balls, agility drills, &amp; sport specific exercises (HR &amp; RPE)</td>
<td>Popovich et al., (2019)</td>
</tr>
<tr>
<td>Perceived exertion of “mild” to “moderate” on Borg scale</td>
<td>Maerlender et al., (2015)</td>
</tr>
<tr>
<td>Borg RPE of 11 for 2-5 minutes; increase RPE 1 every 5 min</td>
<td>Kurowski et al., (2016)</td>
</tr>
<tr>
<td>15 min @ 100-120 bpm; 30 min @ 100-120 bpm; 30 min @ 140; 1 min max sprint every 5 min for 30 min</td>
<td>Lawrence et al., (2018)</td>
</tr>
<tr>
<td>60% APMHR</td>
<td>Dobney et al., (2018)</td>
</tr>
</tbody>
</table>
Duration & Frequency - How long should patients exercise...and how often?

- Most studies use **20-30 minutes**
- Same duration as achieved on the treadmill test (Leddy et al., 2010; Grabowski et al., 2017)
- **15 min; 30 min;** sprints for 30 min (Lawrence et al., 2018)
- Individualized/symptom limited **4-50 min** (Popovich et al., 2019)
- Frequency **5-7 days per week**

To summarize:

- **Frequency:** Most studies used daily exercise with at least one rest day per week
- **Intensity:** Most studies used heart rate & prescribed “sub-symptom threshold”; some used Rate of Perceived Exertion (RPE)
- **Type:** Most studies used aerobic exercise—most utilizing an exercise bike
- **Time:** Most studies recommended 20-30 minutes
- **Timing:** Early studies were with subjects with prolonged symptomatology (PCS); more recent research (including the most recent Consensus Statement) recommend starting 2-10 days post-injury
• Strict rest until the complete resolution of concussion-related symptoms is **not beneficial** for SRC
• **Relative (not strict) rest**, including ADLs and reduced screen time, is indicated immediately & for up to 2 days post injury
• Individuals can **return to light-intensity PA** that does not more than mildly exacerbate symptoms, during the initial 24-48 hours (avoid risk of contact or falling)
• Individuals can systematically **advance their exercise intensity** based on the degree of symptom exacerbation experienced during the prior bout of exercise
• Mild symptom increase during PA or exercise **does not delay recovery**.
• Prescribed early aerobic exercise within 2-10 days of SRC is **effective for reducing incidence of PPCS**
What’s in Your Tool Box?

- Consensus Statement on Concussion in Sport (2023)
- Evidence-based approach to prescribing exercise for your concussion patients
- Remember the FITT(T) Principle
- Use Heart Rate (HR), Rate of Perceived Exertion (RPE), and/or your best clinical judgement
- Learn to use the Buffalo Concussion Treadmill Test (BCTT) or the Buffalo Concussion Bike Test (BCBT)
- Remember that Exercise is Medicine
References

References

Thank You!!