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

OHSU BRAIN INSTITUTE

Mild Traumatic Brain Injury Symposium

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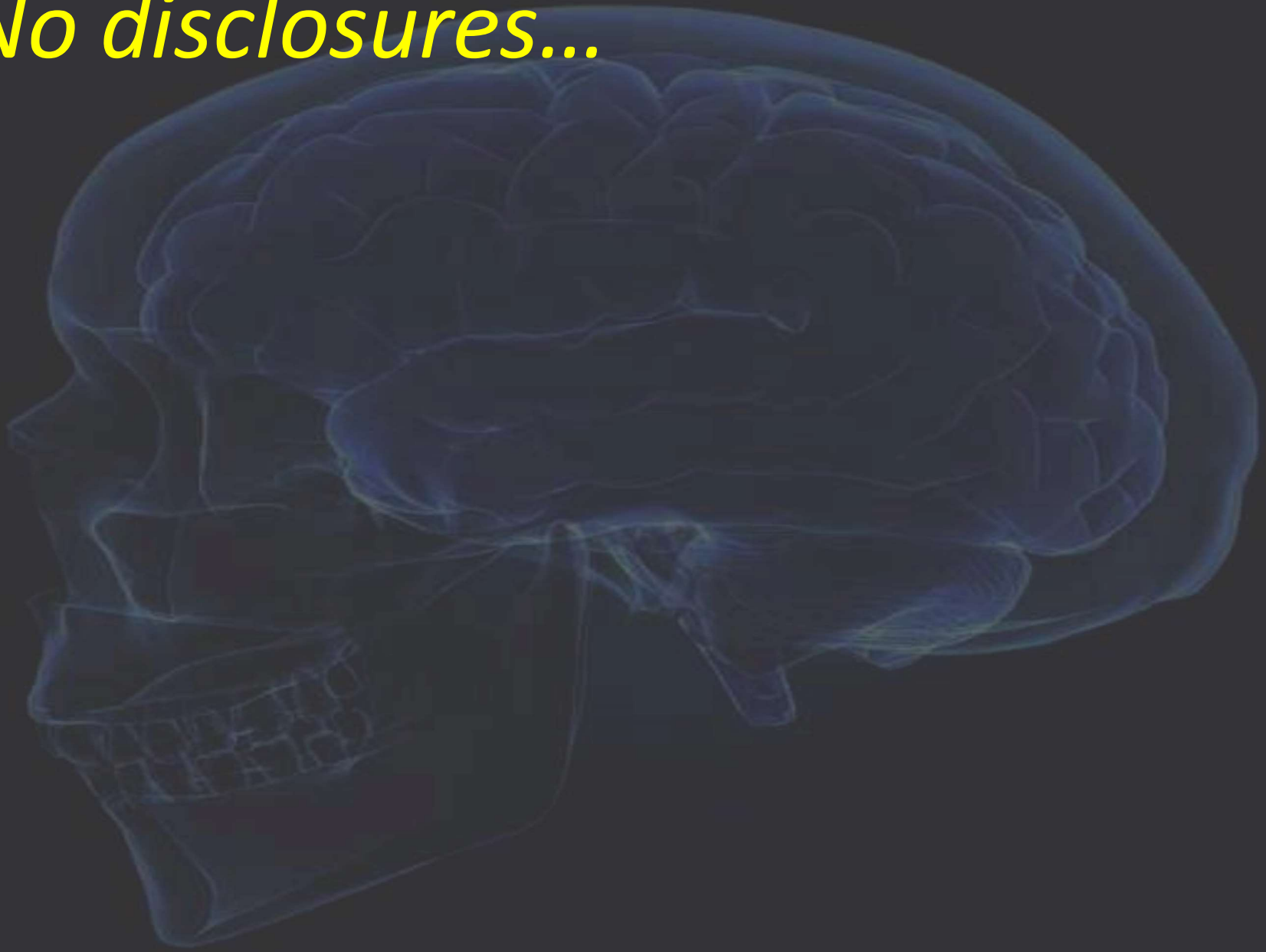
No disclosures…



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.enaturalawakenings.com/Health-Briefs-Archive/Silence-De-Stresses-the-Brain/

https://maymassage.info/thong-tin-can-biet-ve-xe-dap-tap-the-duc-reebok-z7-re1-11710/

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)

J Head Trauma Rehabil

Acute Cognitive and Physical Rest May Not Improve Concussion Recovery Time

Thomas A. Buckley, EdD, ATC; Barry A. Munkasy, PhD; Brandy P. Clouse, MS, ATC

Original Article

Prolonged Activity Restriction After Concussion: Are We Worsening Outcomes?

Clinical Pediatrics
1–9

DOI: 10.1177/0009922815589914
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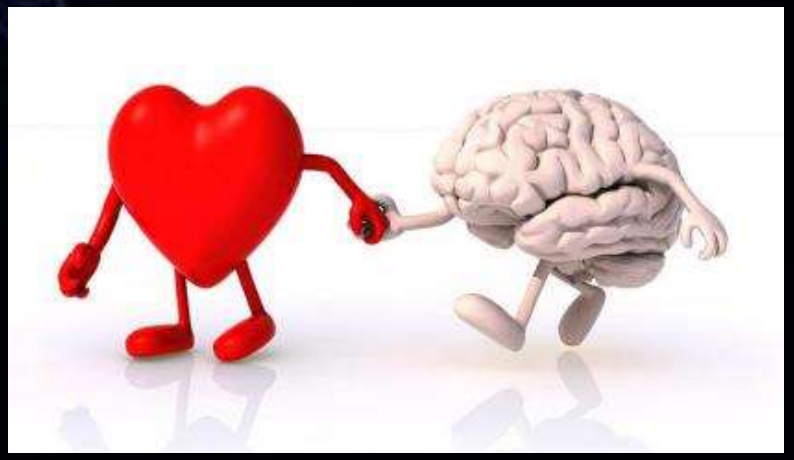
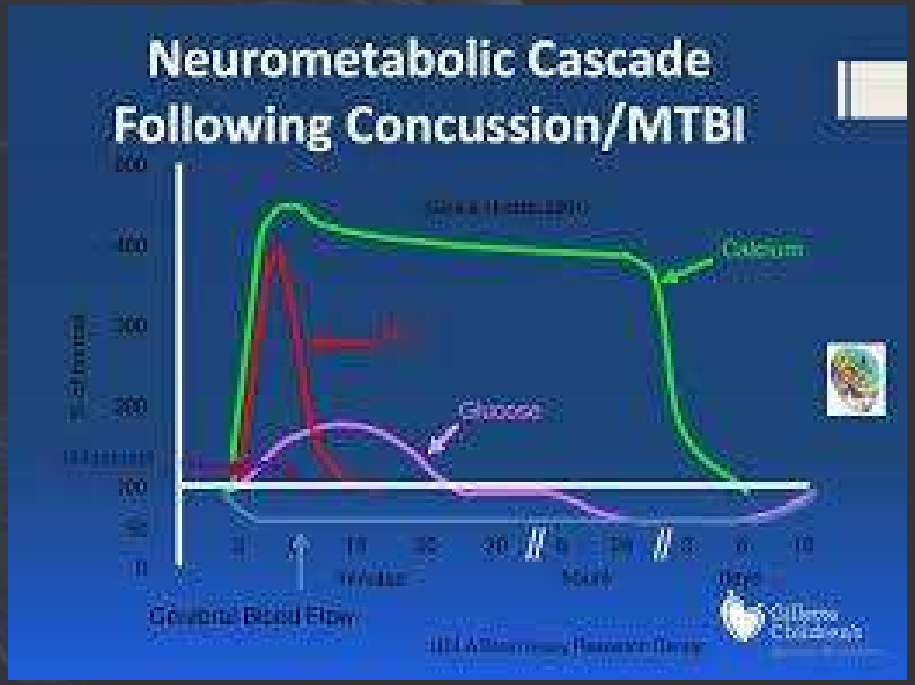
Marc DiFazio, MD[1], Noah D. Silverberg, PhD[2,3], Michael W. Kirkwood, PhD[4,5], Raquel Bernier, MD[1], and Grant L. Iverson, PhD[6,7,8,9]



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)*

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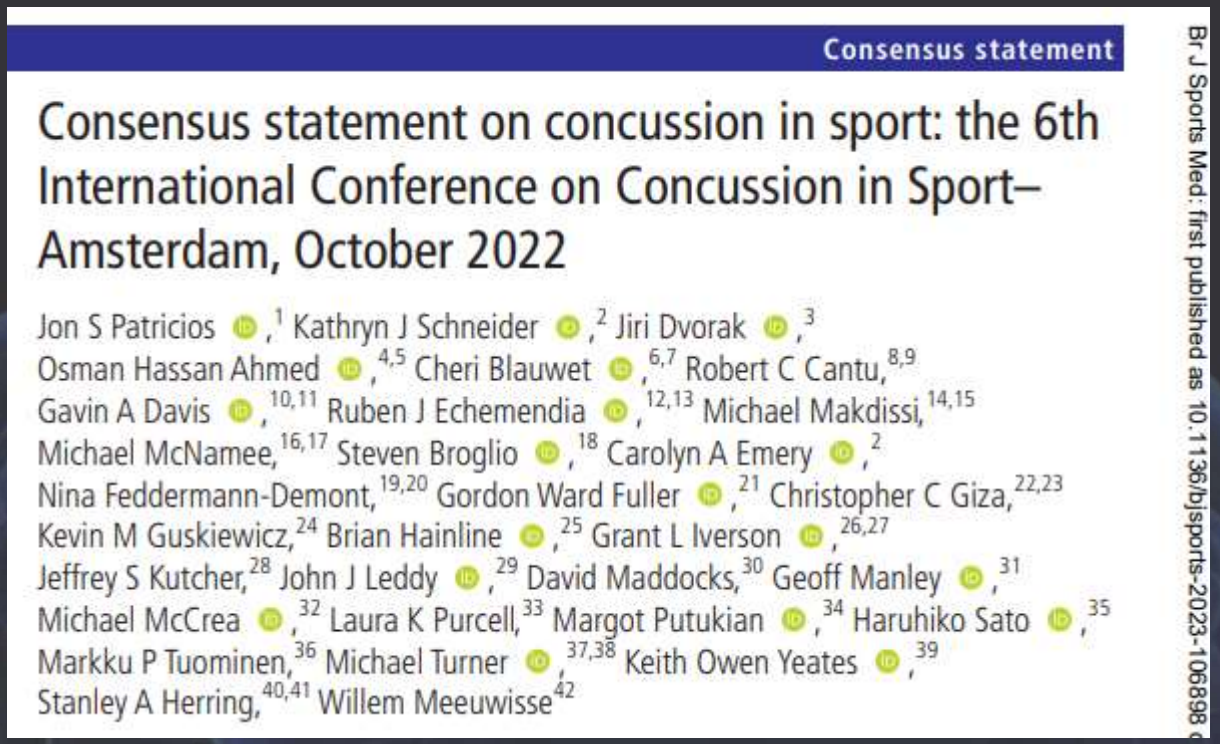
Exercise Intolerance

- 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)



Consensus statement

Consensus statement on concussion in sport: the 6th International Conference on Concussion in Sport–Amsterdam, October 2022

Jon S Patricios [1], Kathryn J Schneider [2], Jiri Dvorak [3], Osman Hassan Ahmed [4,5], Cheri Blauwet [6,7], Robert C Cantu, [8,9] Gavin A Davis [10,11], Ruben J Echemendia [12,13], Michael Makdissi, [14,15] Michael McNamee, [16,17] Steven Broglio [18], Carolyn A Emery [2], Nina Feddermann-Demont, [19,20] Gordon Ward Fuller [21], Christopher C Giza, [22,23] Kevin M Guskiewicz, [24] Brian Hainline [25], Grant L Iverson [26,27], Jeffrey S Kutcher, [28] John J Leddy [29], David Maddocks, [30] Geoff Manley [31], Michael McCrea [32], Laura K Purcell, [33] Margot Putukian [34], Haruhiko Sato [35], Markku P Tuominen, [36] Michael Turner [37,38], Keith Owen Yeates [39], Stanley A Herring, [40,41] Willem Meeuwisse [42]

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- "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 2–10days after SRC…"*(Patricios et al., 2023)*

The FITT Principle

*Frequency
*Intesity
*Time
*Type
*Timing (Lawrence et al., 2018)

https://www.google.com/search?q=fitt+principle&safe=strict&source=lnms&tbm=isch&sa=X&ved=0ahUKEwjMxN7EgovcAhWFOn0KHfp6CzQQ_AUICigB&biw=1366&bih=613#imgrc=8MuBs4RuGYLtlM

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)

Author (year)	Time following injury
Gagnon et al., 2009	4-18 weeks
Leddy et al., 2010	6-40 weeks
Baker et al., 2012	8-40 weeks
Maerlender et al., 2015	"recently concussed"
Lawrence et al., 2018	1-10 days
Micay et al., 2018	6 days
Leddy et al., 2019	<10 days (mean 5 days)
Popovich et al., 2019	<16 days vs >16 days

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)

Sports Medicine (2019) 49:683–706
https://doi.org/10.1007/s40279-019-01065-1

REVIEW ARTICLE

A Physiologically Based Approach to Prescribing Exercise Following a Sport-Related Concussion

Phillip R. Worts[1,2,3] · Scott O. Burkhart[4,5] · Jeong-Su Kim[2,3,6]

https://maymassage.info/thong-tin-can-biet-ve-xe-dap-tap-the-duc-reebok-z7-re1-11710/

Intensity-At what intensity level should patients exercise?

Intensity	Authors
Stationary bike; elliptical; running; med balls, agility drills, & sport specific exercises (HR & RPE)	Popovich et al., (2019)
Perceived exertion of "mild" to "moderate" on Borg scale	Maerlender et al., (2015)
Borg RPE of 11 for 2-5 minutes; increase RPE 1 every 5 min	Kurowski et al., (2016)
15 min @ 100-120 bpm; 30 min @ 100-120 bpm; 30 min @ 140; 1 min max sprint every 5 min for 30 min	Lawrence et al., (2018)
60% APMHR	Dobney et al., (2018)
80% of HR achieved on a sub-maximal treadmill test (Buffalo Protocol)	Leddy et all, (2010); Baker et al., (2012); Clausen et al., (2015); Polak et al., (2015); Cordingly et al., (2016); Leddy et al., (2019)

Borg's Rating of Perceived Exertion (RPE) Scale

Perceived Exertion Rating	Description of Exertion
6	No exertion. Sitting & resting
7	Extremely light
8	
9	Very light
10	
11	Light
12	
13	Somewhat hard
14	
15	Hard
16	
17	Very hard
18	
19	Extremely hard
20	Maximal exertion

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

https://www.rawpixel.com/image/378309/premium-photo-image-stopwatch-african-african-descent

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 symptomology (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

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Thank You!!

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