

# Updates in Therapy for Concussions

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# About Akron Children's

- Ranked a Best Children's Hospital by *U.S. News & World Report*
- Magnet® Recognition for Nursing Excellence
- Largest independent pediatric provider in northern Ohio
  - 2 hospital campuses
  - 60+ locations offering primary care, specialty services and urgent care
  - 5,800 employees
- With more than 1 million patient visits each year, we've been leading the way to healthier futures for children and communities through expert medical care, prevention and wellness programs since 1890.



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# Concussion vs mTBI

- Mild Traumatic Brain Injury
- Per the 2018 CDC Guidelines on the diagnosis and management of mild traumatic brain injury among children
- Includes
  - “minor traumatic brain injuries”
  - “mild traumatic brain injuries”
  - “concussions”



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# Whiplash and Concussion

- “Concussion in Combination with Whiplash-Associated Disorder May Be Missed in Primary Care”
  - Clinical Commentary: Rebbeck, Evans, Elliot,
  - Journal of Orthopaedic & Sports Physical Therapy 2019
  - Guidelines for whiplash and concussion are developed and implemented separately
  - May contribute to misdiagnosis



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# Second Impact Syndrome

- (SIS) occurs when the brain swells rapidly, and catastrophically, after a person suffers a **second** concussion before **symptoms** from an earlier one have subsided. This **second** blow may occur minutes, days or weeks after an initial concussion, and even the mildest grade of concussion can lead to SIS



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- **Fatal Second Impact Syndrome in Rowan Stringer, A 17-year-Old Rugby Player**
  - » The Canadian Journal of Neurological Sciences
  - » Tator, Starkes et al., 2019
  - May 8<sup>th</sup> 2013, Ontario, Canada
  - 17 year old, team captain
  - High tackled, upended, landed on her head on the ground
  - She sat up momentarily then lost consciousness
  - Large, left decompressive craniotomy was performed
  - Condition continued to decline and on day 4 she passed away
  - Neurological team could not explain the profound, immediate neurological decline on the field, and the massive brain swelling that followed causing her death
  - Investigation revealed excellent care and response times not only on the field but also in transport and in the hospital



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- Review of her texts to her friends in the 5 days leading up to the fatal injury
  - She texted about the blows she sustained during the game on May 3, 2013 and then again 3 days later in a game where she was “kicked in the head”
  - Symptoms that she complained about to her friends included headache, fatigue, and tinnitus making it highly likely that she had sustained concussions on May 3<sup>rd</sup> and May 6<sup>th</sup> (fatal blow was on May 8<sup>th</sup>)
  - They found that no adult diagnosed a concussion or were told about her symptoms
  - She, as team captain, felt responsible and even obligated to keep playing while injured
  - Tragically, she had even texted her friends that she had even “googled concussion” and surmised that she “probably had a concussion”



- If: “Repeated mTBI’s occurring over an extended period of time can result in cumulative neurological and cognitive deficits.”
  - Centers for Disease Control and Prevention
- We Know: “Note that every one pound increase in neck strength leads to a decrease in 5% chance of sustaining a concussion”
  - Collins et al (2014)



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# Neck Strength

- Neck strength is a significant predictor of concussion among High school athletes
  - Collins, Fletcher et al 2014



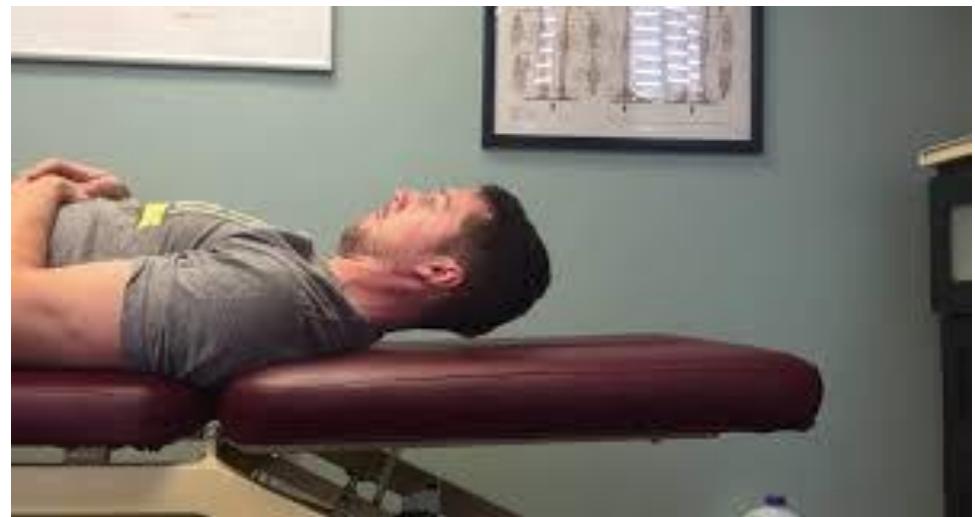
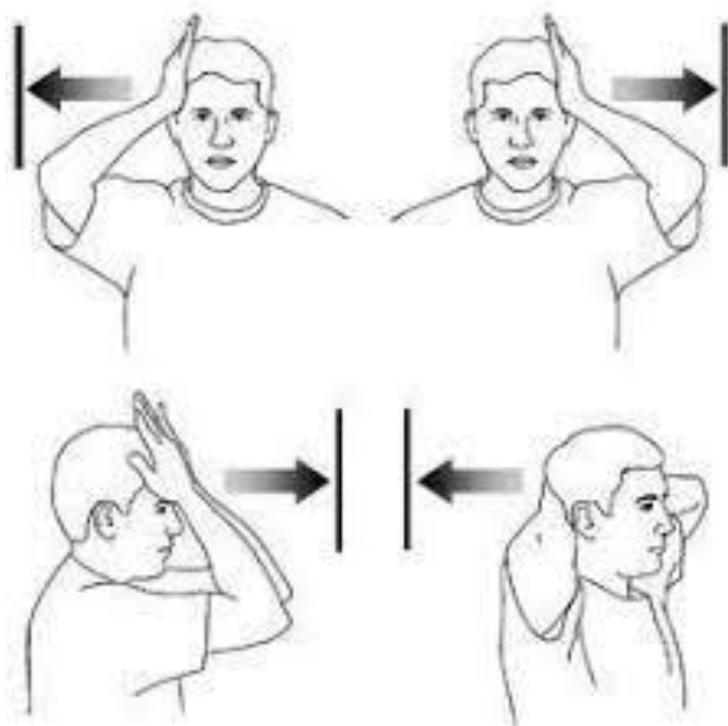
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- “The Cervical muscles are to the brain as the hip is to the knee”
  - No one ever



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# Neck Strength



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# Neck Strength



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# C1-C3 Origin of sx

- Recent Delphi Study surveyed experienced healthcare professionals treating concussions
  - Recommended
    - Cervical joint position error test
    - Cervical flexion-rotation test
    - Smooth pursuit neck torsion test
    - Head-neck differentiation test



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Use of graded exercise training  
in concussion and return-to-  
activity management. Leddy JJ,  
Willer B. Curr Sports Med Rep.  
2013;12(6):370-376.



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- Early Subthreshold Aerobic Exercise for Sport-Related Concussion
  - A Radomized Clinical Trial
    - John J Leddy, MD; Mohammad N. Haider MD; Michael J. Ellis MD; et al
    - JAMA Pediatrics 2019; 173(4):319-325
  - Objective: To assess the effectiveness of subsymptom threshold aerobic exercise vs a placebo-like stretching program prescribed to adolescents in the acute phase of recovery from SRC.
  - Results: A total of 103 participants were included (aerobic exercise: n=52; 24 female (46%); stretching, n=51; 24 female (47%). Participants in the aerobic exercise group were seen a mean (SD) of 4.9 (2.2) days after the SRC, and those in the stretching group were seen a mean (SD) of 4.8 (2.4) days after the SRC. There were no differences in age, sex, previous concussions, time from injury, initial symptom severity score, or initial exercise treadmill test and physical examination results. Aerobic exercise participants recovered in a median of 13 days, whereas stretching participants recovered in 17 days.
  - “Since aerobic exercise training has beneficial effects on autonomic nervous system regulation, cerebral blood flow regulation, cardiovascular physiology, and brain neuroplasticity, it is reasonable to consider whether subsymptom threshold aerobic exercise training could help patients with concussion recover more rapidly.”
  - Conclusion: Individualized subsymptom threshold aerobic exercise treatment prescribed to adolescents with concussion symptoms during the first week after SRC speeds recovery and may reduce the incidence of delayed recovery.



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# Buffalo Concussion Treadmill Test (BCTT)

- Evaluate exercise tolerance in patients with PCS
- Differentiate cause of sx
  - Physiologic PCS
  - Cervicogenic PCS
  - Vestibulo-ocular PCS
- Develop a graded Cardio Program for HEP



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# Practical Management: Prescribing Subsymptom Threshold Aerobic Exercise for Sport-Related Concussion in the Outpatient Setting

Bezherano, I. Haider, M. Willer, B. Leddy, J. Clinical Journal of Sports Med:2020;00:1-4

- Method 1
  - Exercise Prescription With Exertion Testing and HR Monitor
- Method 2
  - Exercise Prescription With Exertion Without a Heart Rate Monitor
- Method 3
  - Exercise Prescription Without Exertion Testing



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- Concussion in Combination with Whiplash-Associated Disorder May be Missed in Primary Care: Key Recommendations for Assessment and Management. *J Orthop Sports Phys Ther.* 2019 Nov;49(11):819-828.doi:10.2519/8946.Epub 2019 Oct 14.
- Early Subthreshold Aerobic Exercise for Sport-Related Concussion, A randomized Clinical Trial. Leddy J, Haider M, et al., *JAMA Pediatrics*, 2019;(4):319-325.
- Fatal Second Impact Syndrome in Rowan Stringer, a 17-Year-Old Rugby Player. Tator C, Starkes J, Dolansky G, Quet J, Michaud J, Vassilyadi M., *Can J Neurol Sci.* 2019 May;46(3):351-354. doi: 10.1017/cjn.201914.Epub 2019 Apr 4.
- Neck strength: a protective factor reducing risk for concussion in high school sports. Collins CL, Fletcher EN, Fields SK, Kluchurosky L, Rohrkemper MK, Comstock RD, Cantu RC. *J Prim Prev.* 2014;35:309–319.
- Report from the Pediatric Mild Traumatic Brain Injury Guideline Workgroup: systemic review and clinical recommendations for healthcare providers on the diagnosis and management of mild traumatic brain injury among children. Centers for Disease Control and Prevention. ( Assessed February 15, 2018)
- Sports-related recurrent brain injuries Centers for Disease Control and prevention. –United States MMWR 1997;46(10):224-221
- Use of graded exercise training in concussion and return-to-activity management. Leddy JJ, Willer B. *Curr Sports Med Rep.* 2013;12(6):370-376.



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