



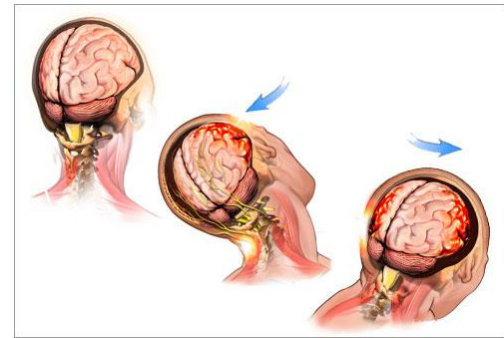
Concussions

Alyssa Loeb, Bethany Hightower, Kelsey Moshier, Lauren Provencio

Definition

- Head injury due to contact and/or acceleration/deceleration forces - synonymous with a mild TBI in medical literature

- Concussion Conference in 2012 - “Concussion is a brain injury and is defined as a complex pathophysiological process affecting the brain, induced by traumatic biomechanical forces.”



Signs/Symptoms

...just a friendly reminder

- Headache, pressure in head
- Temporary loss of consciousness
- Confusion/dizziness
- Ringing in the ears
- Nausea/vomiting
- Fatigue
- Appearing dazed



Remember that symptoms may be subtle and may not be immediately apparent

Prevalence, Etiology & Risk Factors

Risk Factors:

-Those involved in contact sports



-Previous history of concussions

-Females 2-2.5x more likely than males

- Neck strength
- Reporting concussions

Did you know...**300,000**
concussions occur in the US
each year

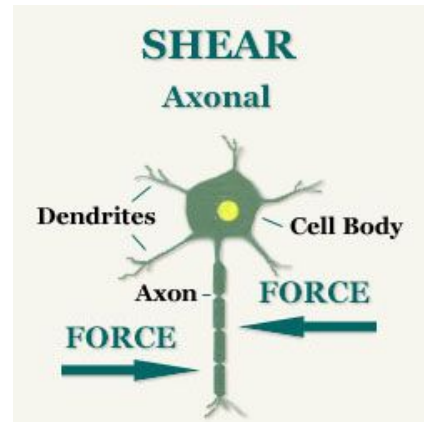
Etiology

-Acceleration, deceleration, and rotational forces

-Proposed that greater forces are required to produce injury in pediatric vs. adult brain

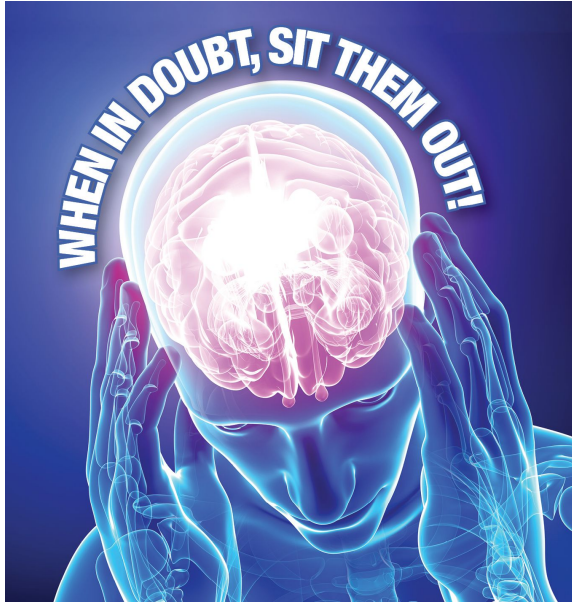
- May be due to developing brain and skull but unclear

Mechanism of Injury



- Biomechanical force causes shearing of the axons and “neuronal crisis”
- Disruption of neuronal cell membranes
 - Too much K^+ out of the cell (depolarization)
 - Na^+ K^+ pumps work extra hard (need more ATP)
 - Increase in glucose metabolism at the site of injury
- Leads to 50% reduction of cerebral blood flow
- So much energy to fix the problem causes the brain to be in a vulnerable state
 - Symptoms, do not return to play

Complications



Sequelae for Concussion:

- Second Impact Syndrome
- Postconcussion Syndrome
- Post-traumatic Headaches
- Post-traumatic Epilepsy
- Post-traumatic Vertigo
- Cervical Spine Injury
- Cranial Nerve Injury
- Chronic Traumatic Encephalopathy

Case Study

Most studies focused on high school athletes and adults, no studies focused on the longitudinal progression of a concussion in children...

 **So that's what this study did!** 

Meet Faith Solo

- 8 year old soccer player
- Fell backwards and hit the back of her head during play
- No LOC
- Typical symptoms present
- Before concussion presented with no academic difficulties/learning disabilities



Patient Impairments & Limitations

- Report cards were compared, performed worse in French and Mathematics post concussion
- At 22 wks post concussion pt. was finally scoring normally
- Childhood concussion can affect attentional capacity
- Changes in academic performance stress the importance of proper return to sport but also proper return to academic

Sign PT's up!



Time to Treat

First and foremost (Week 1):

- Rest is **key**, both physical and mental
- — —
- Encourage pt. to sleep
 - Dix-Hallpike can be performed if vestibular disturbance is suspected
 - Treat BPPV if you feel appropriate

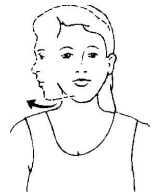


- Muscles of the neck may be tight

-E-stim can be performed to alleviate tightness/pain

-STM can alleviate neck tension

-simple neck stretches can be performed (HEP)



Time to Treat

Week 2-3:

- Typically between 2-3 wks pt can perform treadmill test (22 days)
- Pt. must be asymptomatic at rest before performing Buffalo Concussion Treadmill Test (BCTT)

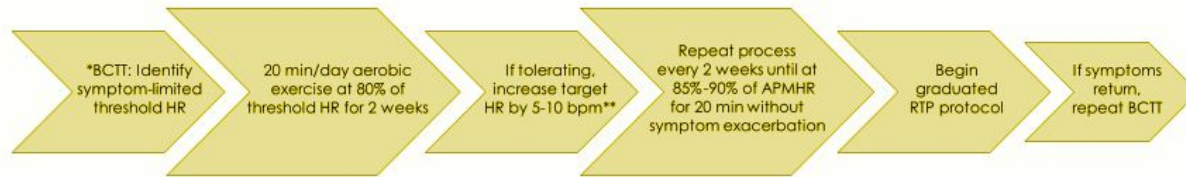


Figure 2: Use of the BCTT and exercise prescription for RTA in physiologic PCD. APMHR, age-predicted maximum HR. *After 3 wk of symptoms. **5 bpm for nonathletes; 10 bpm for athletes. To obtain a more precise target HR, consider repeating the BCTT every 2 wk.

Does this ring a bell...

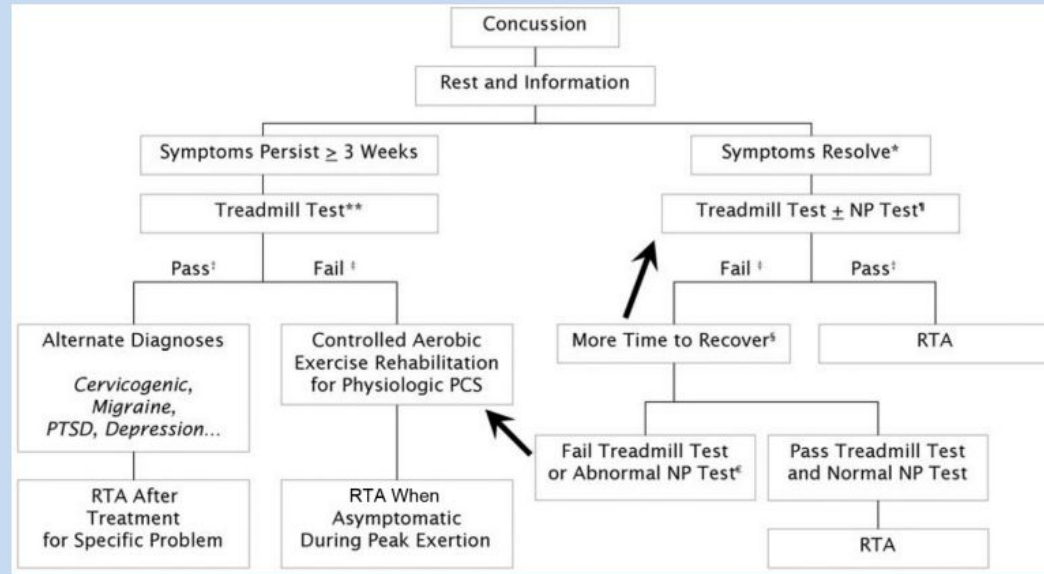


Figure 2. Return-to-activity algorithm for concussion and postconcussion syndrome. *Time for symptom resolution will vary depending on clinical circumstances. Most athletes recover within 1 to 3 weeks. **Treadmill testing in patients with persistent symptoms should not be performed before 3 weeks after injury. Neuropsychological testing is not indicated, because the patient is still symptomatic. †If neuropsychological testing has been used, assume that there is a baseline preinjury test or valid normative data for the particular patient. ‡Exercise to exhaustion without exacerbation of symptoms. ‡Exercise stopped at a submaximal effort level because of symptom exacerbation. §Repeat testing interval will vary depending on clinical circumstances; it may be several days to several weeks. If athlete is not recovering, consider aerobic exercise rehabilitation. If computerized neuropsychological testing has been used and remains abnormal, continue exercise treatment and consider consultation with a neuropsychologist to evaluate for a specific cognitive deficit. RTA, return to activity; PCS: postconcussion syndrome; NP, neuropsychological.

Table 1.**Absolute and relative contraindications to performing the Buffalo Concussion Treadmill Test.**

| <i>Absolute Contraindications to Performing the BCTT</i> | |
|--|--|
| History | Unwilling to exercise. Increased risk for cardiopulmonary disease as defined by the American College of Sports Medicine. ^a |
| Physical examination | Focal neurologic deficit. Significant balance deficit, visual deficit, or orthopedic injury that would represent a significant risk for walking/running on a treadmill. |
| <i>Relative Contraindications to Performing the BCTT</i> | |
| History | Beta-blocker use. Major depression (may not comply with directions or prescription). Does not understand English. |
| Physical examination | Minor balance deficit, visual deficit, or orthopedic injury that increases risk for walking/running on a treadmill. SBP > 140 mm Hg or DBP > 90 mm Hg. Obesity: body mass index ≥ 30 kg·m ⁻² . |

Once pt. Is
able to

pass
BCTT...

Zurich Conference Guidelines

TABLE 2.

Return-to-Play Protocol

| Stage | Activity | Objective |
|----------------------------|--|---|
| No activity | Complete physical rest. | Recovery |
| Light aerobic exercise | Walking, swimming, aerobic exercise up to 70% of maximum predicted heart rate; no resistance training. | Increase heart rate. |
| Sport-specific exercise | Sport-specific exercise such as skating, running drills; no head impacts. | Add movement. |
| Noncontact training drills | Progress to complex drills; add resistance training. | Exercise, coordination, add cognitive load. |
| Full contact practice | Normal practice after cleared by medical personnel. | Restore confidence and timing, allow assessment of functional skills. |
| Return to play | Normal game play. | Full return to play. |

Source: Adapted from Consensus Statement on Concussion in Sport 3rd International Conference on Concussion in Sport held in Zurich, November 2008.¹

Time to Treat

Weeks 3-4 (depends on pt):

Light Aerobic exercise at this time helps upregulated BDNF and cognitive performance

-stationary bike, swimming

-20 mins as long as asymptomatic

Vestibular exercise

-walking with head turns, balance with eyes closed, SLS on Airex



Time to Treat

Week 4-5:

Sport specific activity

- Shuttle run, Slalom cone drills,
Frog jumps, Alpine Jumpers

-2x8-10 reps, 2x/wk

-SHOULD BE ASYMPTOMATIC



Time to Treat

Week 5-6:

Complex Drills

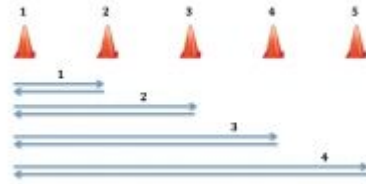
-Drills involving soccer ball,
Slalom cone drill w/ ball, ladder
drill, mini suicides

-replicate practice (2x/week)

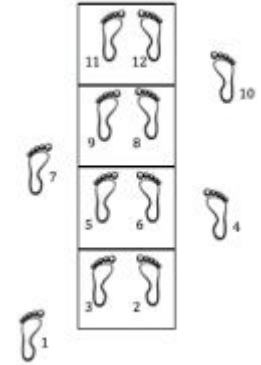
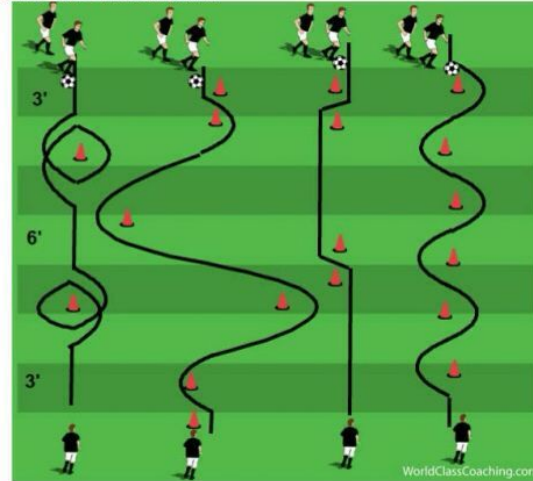
Resistance Exercise

-LE monster walks with TB, band
resisted lateral jumps (cone set
apart 10 ft, walk down and backx3)

-Wall squats (15secx3)



DRIBBLING THROUGH CONES DIAGRAM



Time to Treat

Week 6:

Return to practice after being cleared by medical personnel

Return to play if practice goes well



Whatcha Need to Know!

- 1) **Encourage rest!** Both physical and mental
- 2) Patient needs to be **asymptomatic** before performing BCTT
- 3) Patient needs to remain **asymptomatic** throughout the course of the treatment
- 4) Begin with **low intensity exercises** and progress to **sports specific** high intensity exercise
- 5) Typically treatment from a concussion takes about **6 weeks** with proper rest initially



References

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