Concussions: The *Impact* of an Increasing Problem

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What is a Concussion?

- https://www.youtube.com/watch?v=Sno_0Jd8GuA
Concussion

• Definition:

“A concussion is a type of traumatic brain injury (TBI) caused by a bump, blow, or jolt to the head that can change the way your brain normally works. Concussions can also occur from a fall or a blow to the body that causes the head and brain to move quickly back and forth”. (Center for Disease Control & Prevention, 2014)
Closed Head Injury

• **Coup**
  - Bruising from brain being compacted by the bone pushing inward, even if the skull is not fractured (Filley, 2001; Iverson & Lange, 2011; Kolb et al., 2009).

• **Countercoup**
  - Bruising from the brain against the opposite side of the skull (Filley, 2001; Iverson & Lange, 2011; Kolb et al., 2009).

• Force and movement can cause shearing of nerve fibers
  - Shearing may damage major fiber tracts of the brain
    - Corpus callosum
      - Essential in the communication between the two sides of the brain
Concussion

- Energy crisis, nutrient mismatch, inflammatory microenvironment, and potential loss of structural integrity.

- Repeat concussion(s) before recovery leads to further injury, prolongs recovery, and may worsen short & long-term outcome.

(Center for Disease Control & Prevention, 2014)
Introduction

• Each year, more than half a million children under 15 years old sustain a traumatic brain injury (TBI) in the United States (Fulton, et al., 2012; Faul, Xu, Wald, & Coronado, 2010; Kraus, 1995).
  • Mild
  • Moderate
  • Severe

• Many suffer negative implications ranging from academic achievement and physical disabilities
Introduction

• ~300,000 head injuries per year in sports & recreation activities
  • 250,000 “concussions”
• 5 to 20% of high school football players sustain a concussion each season
• Other sports with significant concussion risk:
  – Hockey
  – Wrestling
  – Gymnastics
  – Cheerleading
  – Soccer
  – Skateboarding
  – Etc....

(Center for Disease Control & Prevention, 2014)
Pathophysiology

• Diffuse axonal injury (DAI)
  – The diffuse shearing of axons from the sudden deceleration or rotational forces, places the frontal and temporal lobes, corpus callosum, and other white matter regions including the upper brainstem and fornix at risk to neurologic deficits (DeCuypere & Klimo, 2012; Filley, 2001; Lezack, 2012).

• Cellular level
  – Mechanical forces injure the underlying structural elements of the neuron leading to cellular damage/death (Iverson & Lange, 2011; Lezack et al., 2012).
  – White matter damage leads to reduced normal rates of processing speed required for the integration of the two hemispheres (Lezack et al., 2012).

• Problems of attention and concentration, memory functions, and mental slowing that tend to be associated with diffuse damage (Roman et al., 2003).
## Signs & Symptoms of a Concussion

<table>
<thead>
<tr>
<th>Thinking/Remembering</th>
<th>Physical</th>
<th>Emotional/Mood</th>
<th>Sleep</th>
</tr>
</thead>
<tbody>
<tr>
<td>Difficulty thinking clearly</td>
<td>Headache</td>
<td>Irritability</td>
<td>Sleeping more than usual</td>
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<td></td>
<td>Fuzzy or blurry vision</td>
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<tr>
<td>Feeling slowed down</td>
<td>Nausea or vomiting (early on)</td>
<td>Sadness</td>
<td>Sleep less than usual</td>
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<td></td>
<td>Dizziness</td>
<td></td>
<td></td>
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<tr>
<td>Difficulty concentrating</td>
<td>Sensitivity to noise or light</td>
<td>More emotional</td>
<td>Trouble falling asleep</td>
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<td></td>
<td>Balance problems</td>
<td></td>
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<tr>
<td>Difficulty remembering new information</td>
<td>Feeling tired, having no energy</td>
<td>Nervousness or anxiety</td>
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*Center for Disease Control & Prevention, 2014*
How Can I Recognize a Possible Concussion?

• 1) A forceful bump, blow, or jolt to the head or body that results in rapid movement of the head.

  AND

• 2) Any change in the athlete’s behavior, thinking, or physical functioning.

(Center for Disease Control & Prevention, 2014).
Signs Observed by Coaching Staff

- Appears dazed or stunned
- Is confused about assignment or position
- Forgets an instruction
- Is unsure of game, score, or opponent
- Moves clumsily
- Answers questions slowly
- Loses consciousness (*even briefly*)
- Shows mood, behavior, or personality changes
- Can’t recall events *prior* to hit or fall
- Can’t recall events *after* hit or fall

*(Center for Disease Control & Prevention, 2014)*
Symptoms Reported by Athlete

- Headache or “pressure” in head
- Nausea or vomiting
- Balance problems or dizziness
- Double or blurry vision
- Sensitivity to light
- Sensitivity to noise
- Feeling sluggish, hazy, foggy, or groggy
- Concentration or memory problems
- Confusion
- Does not “feel right” or is “feeling down”

(Center for Disease Control & Prevention, 2014)
Friendly Reminder

• Remember, you can’t see a concussion and some athletes may not experience and/or report symptoms until hours, days, or weeks after the injury.  
  (Center for Disease Control & Prevention, 2014)
What Should You Do When A Concussion Occurs?

- 4 step-action plan:

1. *Remove* the athlete from play.
   - Have the athlete be evaluated on the sideline
2. Ensure that the athlete is *evaluated* by a health care professional experienced in evaluating for concussion.
   - Baseline Testing!
   - Neuropsychological Evaluations
3. *Inform* the athlete’s parents or guardians about the possible concussion and give them the fact sheet on concussion.
4. *Keep* the athlete out of play the day of the injury and until a health care professional, experienced in evaluating for concussion, says they are symptom-free and it’s OK to return to play.

*(Center for Disease Control & Prevention, 2014)*
Baseline Testing

• **What is baseline testing?**
  
  o Baseline testing is a pre-season exam conducted by a trained health care professional.
    ✓ Neuropsychologist
  
  o Assess an athlete’s balance and brain function
    ✓ Learning and memory skills,
    ✓ Ability to pay attention or concentrate,
    ✓ How quickly he or she thinks and solve problems
    ✓ Presence of any concussion symptoms.

  o Results from baseline tests (or pre-injury tests) can be used and compared to a similar exam conducted by a health care professional during the season if an athlete has a suspected concussion.

*(Center for Disease Control & Prevention, 2014)*
Baseline Testing

• How is baseline testing information used if an athlete has a suspected concussion?
  ✓ Comparing post-injury test results to baseline test results
  ✓ Identify the effects of the injury and making more informed return to school and play decisions.
  ✓ Education on safely returning to school and play,
  ✓ Tips to aid in recovery (such as rest), danger signs and when to seek immediate care, and how to help reduce an athlete’s risk for a future concussion.

(Center for Disease Control & Prevention, 2014)
Baseline Testing

• What should be included as part of baseline testing?
  ✓ A check for concussion symptoms and balance and cognitive assessments.
    ✩ (e.g., concentration, memory, reaction time)
  ✓ Assess for a prior history of concussion (including symptoms experienced and length of recovery from the injury).
  ✓ Record other medical conditions that could impact recovery after concussion
    ✩ History of migraines, depression, mood disorders, or anxiety, as well as learning disabilities and Attention Deficit/Hyperactivity Disorder.

(Center for Disease Control & Prevention, 2014)
Baseline Testing

• **Who should interpret baseline tests?**
  
  ✓ Only a trained health care professional with experience in concussion management.
  
  ✓ A neuropsychologist should interpret the computerized or paper-pencil neuropsychological test components of a baseline exam.
  
  ✓ Results of neuropsychological tests should not be used as a stand-alone diagnostic tool, but should serve as one component used by health care professionals to make return to school and play decisions.

*(Center for Disease Control & Prevention, 2014)*
Baseline Testing

• How often should an athlete undergo baseline testing?

  ✓ Repeated annually to establish a valid test result for comparison.
  ✓ Baseline computerized or paper-pencil neuropsychological tests may be repeated every 2 years.
  ✓ However, more frequent neuropsychological testing may be needed if an athlete has sustained a concussion or if the athlete has a medical condition that could affect results of the test.

(Center for Disease Control & Prevention, 2014)
Do Children Really Respond Differently Than Adults Following A Concussion?
Neurodevelopmental Changes

- "Young children have fewer consolidated skills than older children so they are at higher risk for neurocognitive difficulties after a TBI because of the loss of previously acquired skills and the failure to develop new abilities" (Fulton et al., 2012).

- Therefore, young children’s vulnerability to neurocognitive deficits may extend beyond those at the time of the injury (Fulton et al., 2012).
  - Young children “grow into” their neurocognitive injuries, which is particularly seen in academic outcomes (Fulton et al., 2012; Anderson et al., 1995).
  - Disruption in early neurocognitive abilities may impede the acquisition of early academic skills, which serve as a foundation for academic learning (Anderson et al., 2006; Barnes et al., 1999; Catroppa, Anderson, Morse, Haritou, & Rosenfeld, 2008; Ewing-Cobbs et al., 1997, 2004, 2006; Taylor & Alden, 1997, Fulton et al., 2012).
Predictors of Neuropsychological Outcome

- Extent of deficit moderated by:
  - Time since injury (recovery period)
  - Age at the time of injury (limits of plasticity)
  - Duration of impaired consciousness
  - Number of lesions
  - Injury severity
    - Mild
    - Moderate
    - Severe
Academic Implications

Chart Title

- Control
- Mild
- Moderate
- Severe

Babikian et al., 2012
What Should You Do If Your Child’s Academics are Affected from a Concussion?
504 Plan vs. IEP

• What is a 504 plan?
  – A plan developed to ensure that a child who has a disability identified under the law and is attending an elementary or secondary educational institution receives accommodations that will ensure their academic success and access to the learning environment.
504 Plan vs. IEP

• What is an IEP?
  – The Individualized Educational Plan (IEP) is a plan or program developed to ensure that a child who has a disability identified under the law and is attending an elementary or secondary educational institution receives specialized instruction and related services.
504 Plan

• When should my child have a 504 plan?
  – A K–12 student with a disability that “substantially limits one or more major life activity”
    • learning, speaking, listening, reading, writing, concentrating, caring for oneself, etc.
  – The child has an identified learning disability (LD) or Attention Deficit Hyperactivity Disorder (ADHD) but does not meet the requirements of IDEA for special education services and supports
  – The child is currently receiving informal accommodations or ongoing support at school
IEP

• When should my child have an IEP?
  – Has an identified disability that impedes learning to the point that the child needs specialized instruction in order to close the gap between the child’s own academic achievement and that of his/her age peers.
Recommendations

• Attention & Concentration
  – Sit toward the front of the room to limit distractions and increase attention.
  – Receive extra time on tasks.
  – Receive copies of lecture notes and/or have access to a note taker.
Recommendations

• Working Memory aka “mental notepad” / Executive Functioning
  • Child needs help breaking down assignments into smaller parts and setting timelines for each section.
  
  • Child will benefit from the use of a planner that should be reviewed by her teachers and parents on a regular basis.
  
  • Child will require additional explanation and guidance on tasks so that she can understand the main idea and set up a step-by-step plan for completion.
Recommendations

• Language
  – It is important to provide instructions using multiple modalities (e.g. visual and auditory). To maximize understanding of information presented, instructions should be presented multiple times, with cues to help initiate tasks.

  – Have your child repeat back directions to verify understanding and comprehension of tasks requested.

  – Provide assistive devices such as note takers, tape recorders, communication boards

  – Utilize paraphrasing, verbal repetition and summarizing
Recommendations

• Memory
  – Child should learn to use mnemonic devices (i.e., easy to remember constructs that can be related back to the data that is to be remembered, such as short poems or special words) to help cue information.
  – Directions should be provided in multiple formats (i.e., oral reminders, charts, lists).
    • Wherever possible, visual aids can be used to supplement instructions because they can be referred to later if directions are forgotten or are unclear.
  – Since child may be more likely to retrieve relevant information with cuing, recognition rather than free recall of information for tests and assignments should be incorporated where possible.
    • This can be in the form of multiple choice, true/false, fill-in-the-blank, matching, etc.
What Can You Do To Prevent A Concussion?

• As a coach or parent, you play a key role in preventing concussions and responding properly when they occur. (Center for Disease Control & Prevention, 2014)
Preseason

• Check with your league, school, or district about concussion policies.
• Create a concussion action plan.
• Educate athletes and other parents or coaches about concussion.
• Monitor the health of your athletes.

(Center for Disease Control & Prevention, 2014)
During the Season: Practices & Games

• **Insist that safety comes first.**
  – Teach and practice safe playing techniques.
  – Encourage athletes to follow the rules of play and to practice good sportsmanship at all times.

• **Teach athletes it’s not smart to play with a concussion.**

• **Prevent long-term problems.**

• **Work closely with league or school officials.**

* (Center for Disease Control & Prevention, 2014)*
Postseason

• Keep track of concussions.
• Review your concussion policy and action plan.
  – Neuropsychological evaluation

*(Center for Disease Control & Prevention, 2014)*
Summary of a Concussion

- https://www.youtube.com/watch?v=_5hlm3FRFYU
That's All Folks

THE DOCTORS

Trust Us Folks!

SET PHASERS TO LOL.COM
Resources

• Center for Disease Control and Prevention
  – http://www.cdc.gov/concussion/sports/

• Barrow Neurological Institute at Phoenix Children’s Hospital
  – http://barrow.phoenixchildrens.org/programs-services/concussion

• Brain Injury Alliance of Arizona
  – http://biaaz.org/