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Occupational Therapy & Concussion

Presented by:
Jaclyn Stephens Ph.D., OTR/L, CBIS

Presentation Outline

• Concussion and Traumatic Brain Injury
• Prevalence & Cause
• Acute & Long-Term Consequences
• Role of Occupational Therapy
1. Describe common causes and symptoms of concussion
2. Define occupational therapy’s role in assessment, treatment, and prevention of concussion
3. Identify resources for evidence-based concussion management
What is a concussion?

[Play Video 1]

Traumatic Brain Injury (TBI) Spectrum

- A concussion is a mild traumatic brain injury (mTBI)

<table>
<thead>
<tr>
<th>Severity of Traumatic Brain Injury[^1]</th>
<th>GCS</th>
<th>PTA</th>
<th>LOC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mild</td>
<td>13-15</td>
<td>&lt;1 day</td>
<td>0-30 mins</td>
</tr>
<tr>
<td>Moderate</td>
<td>9-12</td>
<td>&gt;1 to &lt; 7 days</td>
<td>&gt;30 mins to &lt; 24 hrs</td>
</tr>
<tr>
<td>Severe</td>
<td>&lt; 9</td>
<td>&gt; 7 days</td>
<td>&gt; 24 hrs</td>
</tr>
</tbody>
</table>

[^1]: GCS: Glasgow Coma Scale; PTA: Post-Traumatic Amnesia; LOC: Loss of Consciousness

**Glasgow Coma Scale**

<table>
<thead>
<tr>
<th>BEHAVIOR</th>
<th>RESPONSE</th>
<th>SCORE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eye opening response</td>
<td>Spontaneously</td>
<td>4</td>
</tr>
<tr>
<td>To speech</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>To pain</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>No response</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Best verbal response</td>
<td>Oriented to time, place, and person</td>
<td>5</td>
</tr>
<tr>
<td>Confused</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Inappropriate words</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Incomprehensible sounds</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>No response</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Best motor response</td>
<td>Follows commands</td>
<td>6</td>
</tr>
<tr>
<td>Moves to localize pain</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Flexion withdrawal from pain</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Abnormal flexion (decorticate)</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Abnormal extension (decerebrate)</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>No response</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

Total score: Best response 15 or less; Comatoselike 6 or less; Totally unresponsive 3
Concussion

[Play Video 2]

Are There Different Types of Concussions?

• Concussions are graded as mild (grade 1), moderate (grade 2), or severe (grade 3)
  
  • Grade 1: symptoms last for less than 15 minutes. There is no loss of consciousness.

  • Grade 2: there is no loss of consciousness but symptoms last longer than 15 minutes.

  • Grade 3: the person loses consciousness, sometimes just for a few seconds.

Definition source: Web MD
Prevalence & Other Facts

• CDC estimates reveal that 1.6 million to 3.8 million concussions occur each year

• 5-10% of athletes will experience a concussion in any given sport season

• Fewer than 10% of sport related concussions involve a Loss of Consciousness (e.g., blacking out, seeing stars, etc.)

http://www.concussiontreatment.com/concussionfacts.html#sfaq9

Prevalence & Other Facts (Continued)

• Estimated 47% of athletes do not report feeling any symptoms after a concussive blow

• A professional football player will receive an estimated 900 to 1500 blows to the head during a season

• Impact speed of a professional boxers punch: 20mph

• Impact speed of a football player tackling a stationary player: 25mph

• Impact speed of a soccer ball being headed by a player: 70mph

http://www.concussiontreatment.com/concussionfacts.html#sfaq9
Causes of Concussion

Leading Causes of TBI

- Falls, 40.5%
- Motor vehicle traffic, 14.3%
- Struck by or against, 15.5%
- Assaults, 10.7%
- Unknown/Other, 19.0%

Causes of Sports-Related Concussion (SRC)

Concussions in High School Sports

- Football
- Girls Soccer
- Boys Lacrosse
- Girls Lacrosse
- Boys Soccer
- Wrestling
- Girls Basketball
- Boys Basketball
- Softball
- Girls Field Hockey
- Cheerleading
Immediate Signs of Concussion

Dangerous Signs & Symptoms of a Concussion

- One pupil larger than the other.
- Drowsiness or inability to wake up.
- A headache that gets worse and does not go away.
- Slurred speech, weakness, numbness, or decreased coordination.
- Repeated vomiting or nausea, convulsions or seizures (shaking or twitching).
- Unusual behavior, increased confusion, restlessness, or agitation.
- Loss of consciousness (passed out/knocked out). Even a brief loss of consciousness should be taken seriously.

cdc.gov

Immediate Signs (continued)

Dangerous Signs & Symptoms of a Concussion for Toddlers and Infants

- Any of the signs and symptoms listed in the Danger Signs & Symptoms of a Concussion list.
- Will not stop crying and cannot be consoled.
- Will not nurse or eat.

cdc.gov
Most concussions should resolve in 1 – 6 weeks

Some individuals experience post-concussion syndrome (PCS)

Even in individuals without PCS, researchers have observed residual deficits
Long-Term Consequences

In civilian adults:
- Deficits in gait years after concussion (Martini et al., 2011)
- Insomnia (Mollayeva, Mollayeva, Shapiro, Cassidy, & Colantonio, 2015)
- Poor sleep quality (Towns, Silva, & Belanger, 2015)

In military personnel:
- Psychiatric conditions beyond PTSD (Walker, Franke, McDonald, Sima, & Keyser-Marcus, 2015)

In adolescents:
- Gait & balance problems, 2 months after concussion (Howell, Osternig, & Chou, 2013; Howell, Osternig, Koester, & Chou, 2014)
- Greater severity and number of initial symptoms can negatively impact academic performance (Baker et al., 2015)
**Long Term Consequences**

- In school-aged children
  - Behavior Problems (Taylor et al., 2015)
  - Cognition (Loher, Fatzer, & Riebers, 2014)

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**Post Concussion Syndrome**

[Play Video 3]
Additional Reading

• Concussion and Mild Head Injury
  • Anderson, Heitger, and Macleod, 2006 in Practical Neurology (6: 342-357)

• Sports Related Concussion

• Symptoms of Concussion and Comorbid Disorders

Questions?
Role of Occupational Therapy In Concussion


An Ounce of Prevention is Worth a Pound of Cure
- Benjamin Franklin -

Knowledge is power.
- Francis Bacon -
• **Play safely.** Falls on the playground are a common cause of injury. Check to make sure that the surfaces under playground equipment are safe, soft, and well-maintained (such as wood chips or sand, not dirt or grass).
Infants & Children

• **Make your home safer.** Use home safety devices, such as guards on windows that are above ground level, stair gates, and guard rails. These devices can help keep a busy, active child from taking a dangerous tumble.

cdc.gov

Infants & Children

• **Supervision is key.** Supervise young children at all times around fall hazards, such as stairs and playground equipment, whether you’re at home or out to play.

cdc.gov
Infants & Children

- Keep sports safe. Make sure your child wears protective gear during sports and recreation. For example, when in-line skating, use wrist guards, knee and elbow pads, and a helmet.

[Image of child and adult wearing helmets]

cdc.gov
Adolescents & Children

- CDC Helmet Fact Sheets
  http://www.cdc.gov/headsup/helmets/index.html

- Included sports & activities:
  - Batters Helmet
  - Bike Helmet
  - Catchers Helmet
  - Equestrian Helmet
  - Football Helmet
  - Hockey Helmet
  - Hockey Goalie Helmet
  - Lacrosse Helmet
  - Skateboard Helmet
  - Ski Helmet
  - Snowboard Helmet

Adolescents in Sports

- Fact Sheets for Athletes
  - Customizable (team colors)

  - English & Spanish
    http://www.cdc.gov/headsup/pdfs/youthsports/athletes_eng.pdf

- Fact Sheet for Parents
Heads Up Concussion

For Youth Sport Coaches:

• What Will I Learn in This Training?
  • This course will help you:
    • Understand a concussion and the potential consequences of this injury,
    • Recognize concussion signs and symptoms and how to respond,
    • Learn about steps for returning to activity (play and school) after a concussion, and
    • Focus on prevention and preparedness to help keep athletes safe season-to-season.

We can help athletes stay active and healthy by knowing the facts about concussion and when it is safe for athletes to return to play.

Heads Up to Youth Sports

Partnering to Help Take Concussions Out of Play

CDC partnered with national governing bodies for sport, such as USA Baseball, US Soccer, US Football and USA Cheer, to create concussion materials specific to each sport.

- Soccer
  - Soccer Clipboard Sticker (PDF - 757 KB)
  - Soccer Fact Sheet - Coaches (PDF - 730 KB)
  - Soccer Fact Sheet - Parents (PDF - 575 KB)
  - Soccer Fact Sheet - Athletes (PDF - 779 KB)

- Football
  - Football Clipboard Sticker (PDF - 458 KB)
  - Football Fact Sheet - Coaches (PDF - 742 KB)
  - USA Football Heads Up Football (PDF - 2 MB)

- Baseball
  - Baseball Clipboard Sticker (PDF - 502 KB)

- Field Hockey
  - Field Hockey Clipboard Sticker (PDF - 374 KB)

- Rugby
  - Rugby Clipboard Sticker (PDF - 181 KB)

- Hockey
  - Hockey Poster (PDF - 2 MB)

- Lacrosse
  - Lacrosse Clipboard Sticker (PDF - 764 KB)
  - Lacrosse Fact Sheet - Coaches (PDF - 342 KB)
  - Lacrosse Fact Sheet - Parents (PDF - 904 KB)
  - Lacrosse Fact Sheet - Athletes (PDF - 514 KB)

- Volleyball
  - Volleyball Clipboard Sticker (PDF - 342 KB)
  - Volleyball Clipboard Poster (PDF - 2 MB)

- Cheerleading
  - Cheerleading Clipboard Sticker (PDF - 342 KB)
  - Ice Hockey
  - Hockey Clipboard Sticker (PDF - 342 KB)

- Softball
  - Softball Clipboard Sticker (PDF - 89 KB)
Heads Up Concussion

- Fact Sheet for Youth Sports Officials:
  http://www.cdc.gov/headsup/pdfs/youthsports/heads_up_youth_sports_officials-a.pdf

> Enforce Safe Play. You Set the Tone for Safety.

> Watch out for possible concussions.

- Use injury timeouts to ensure that an athlete with a possible concussion is removed from play. When in doubt, sit them out!
- Enforce the rule that an athlete with a possible concussion cannot return to play on the same day of the injury and until seen and cleared by a health care provider.

Concussion & Football

[Play Video 4]
Second Impact Syndrome

[Play Video 5]

Football & Second Impact Syndrome

[Play Video 6]
Letter to the Editor

11/3/17

(N. P. Reed, 2012)

Acquiring a sports related concussion places athletes at risk for new injuries:
- Another Concussion
- Musculoskeletal Injuries (D, Zaremski, Vincent, & Vincent, 2015)

New Injuries after SRC

Acquiring a sports related concussion places athletes at risk for new injuries:
- Another Concussion
- Musculoskeletal Injuries (D, Zaremski, Vincent, & Vincent, 2015)

Table.
Dimensions of neurocognitive performance in the sport performance context.

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Working Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visual attention</td>
<td>The ability to concentrate on visual input to the exclusion of other less essential stimulus</td>
</tr>
<tr>
<td>Self-monitoring</td>
<td>The ability to focus on proprioceptive/kinaesthetic feedback</td>
</tr>
<tr>
<td>Agility/ fine motor skill</td>
<td>The ability to make minor adjustments in motor activity</td>
</tr>
<tr>
<td>Processing speed/ reaction time</td>
<td>The ability to engage in stimulus-response behavior within an intended time frame</td>
</tr>
<tr>
<td>Dual tasking</td>
<td>The ability to engage in two activities at the same time to maximize goal attainment</td>
</tr>
</tbody>
</table>
Heads Up Clinicians - CDC

• Facts about Concussion for your clients:
  • 20 page brochure:

  • Fact Sheet – English

  • Fact Sheet – Spanish

Adults
Similar Prevention Practices
Older Adults

**Hospital Setting – Awareness of Risk:**
- Age (65 years and older)
- Medical conditions that increase likelihood of falls
- Medications that cause confusion
- Urinary incontinence
- Low vision
- Gait and balance deficits
- Placement of assistive devices
- Environmental:
  - Improper use of bed & chair alarms
  - IVs, oxygen tubing, wires, etc.
  - Wet floors

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Older Adults

**Home Environment - Awareness of Risk**
- Age (65 years and older)
- Medical conditions that increase likelihood of falls
- Medications that cause confusion
- Urinary incontinence
- Low vision
- Gait and balance deficits
- Placement of assistive devices
- Environmental:
  - Oxygen tubing, wiring
  - Poor lighting, especially at night
  - Throw rugs
  - Wet floors, especially in the bathroom & kitchen
  - Clutter
  - Pets
Even with best preventative practice, accidents will happen....

What is the likelihood of referral?

- Concussion Clinic with 262 Patients (Vargo, Vargo, Gunzler, & Fox, 2015):
  - Physical Therapy: 74 patients; 28%
  - Speech Therapy: 60 patients, 23%
  - Neuropsychology: 27 patients, 10.3%
  - Occupational Therapy: 19 patients, 7.2%

In all, 121 (46%) of patients were referred to one or more disciplines.
Evaluation

• Undiagnosed concussions could appear in any practice area

• Know symptoms, acute, & long-term consequences

• Use your interdisciplinary team

After spinal cord injury, an estimated 60-74% of cases have missed diagnoses of mild to moderate TBI

(Kushner, 2015)

<table>
<thead>
<tr>
<th>Medical</th>
<th>Neuro/Musculoskeletal</th>
<th>Psychiatric</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary headache</td>
<td>Subdural hemorrhage</td>
<td>Depression</td>
<td>Unnecessary vision</td>
</tr>
<tr>
<td>Upper respiratory infection</td>
<td>Subarachnoid hematomas</td>
<td>Anxiety</td>
<td>Lumbar disability</td>
</tr>
<tr>
<td>Sinusitis</td>
<td>Skull fracture</td>
<td>PTSD</td>
<td>Dyslexia</td>
</tr>
<tr>
<td>Seasonal allergy</td>
<td>Cervicogenic headache</td>
<td>Somatoform</td>
<td>ADD/ADHD</td>
</tr>
<tr>
<td>Diabetes</td>
<td>Chiari malformation</td>
<td>Acute stress</td>
<td>Substance abuse</td>
</tr>
<tr>
<td>Anemia</td>
<td>Neck pain</td>
<td>Performance anxiety</td>
<td>Malingering</td>
</tr>
<tr>
<td>Vitamin deficiency</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hypothyroidism</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leukemia</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lymphoma</td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

This is also useful as a list of potential confounding conditions in concussion recovery

(Junn, Bell, Shenouda, and Hoffman, 2015)
Treatment

What is best practice?

Rehab?

Rest?

Exercise?

Diet?

Concussions in Military Personnel

Mild
- Primary damage / injury mechanism: predominantly blast, non-penetrating
- Loss of alteration of consciousness: <30 minutes
- Amnesia: <24 hours
- GCS: 13-15
- Imaging: negative
- Comorbidity: Post Traumatic Stress Disorder; overlapping symptoms
- Outcome: Transient neuropsychiatric deficits, mostly full-recovery, long-term neuropsychiatric especially after repeated injuries are frequent

Moderate
- Primary damage / injury mechanism: frequently mixed, blast + acceleration/deceleration, typically non-penetrating
- Loss of alteration of consciousness: >30 minutes, <24 hours
- Amnesia: >24 hours, <7 days
- GCS: 9-12
- Imaging: transient changes
- Comorbidity: PTSD, other injuries
- Outcome: mild-to-moderate, typically chronic, neurological and neuropsychiatric abnormalities

Severe
- Primary damage / injury mechanism: complex, blast + acceleration/deceleration + penetration
- Loss of alteration of consciousness: >24 hours
- Amnesia: >7 days
- GCS: <9
- Imaging: positive, lasting abnormalities
- Comorbidity: Polytrauma, such as multiple-organ injuries
- Outcome: death, significant, neurological and neuropsychiatric deficits, severe, chronic physical and neuropsychiatric disabilities

http://dx.doi.org/10.3389/fneur.2012.00107
Military Personnel

- Progressive return to activity (McCulloch et al., 2015)

More research needed:

Non-Military (Civilian) Adults

- Return to work & workers compensation
  - (Chang, Lombard, & Greher, 2011)
Treatment for Various Populations

College Students & Student Athletes

• Cognitive Rest
  • Unknown if rest or rehab is optimal for returning to learn - Review paper (Eastman & Chang, 2015)

Adolescent Athletes

• Activity Restriction & Prolonged Recovery (DiFazio, Silverberg, Kirkwood, Bernier, & Iverson, 2015)
• Reduced adherence to rest recommendations related to faster recovery (Hugentobler, Vegh, Janiszewski, & Quatman-Yates, 2015)
• RTC: More rest is related to higher reporting of concussion symptom (Thomas, Apps, Hoffmann, McCrea, & Hammeke, 2015)

• Coming Soon: Treatment for Post-Concussion Syndrome
  • Randomized Control Trial using Active Rehabilitation (Reed et al., 2015)
"Health care providers should not underestimate the degree to which symptoms and loss of activities affect young athletes’ general well-being. In addition to the negative impact of concussion symptoms, there is an obvious cost of physical, cognitive, and social activity restrictions for patients recovering from sport-related concussions that should be explicitly addressed." (Stein et al., 2015)
Children

- Case/Pilot Study (Hugentobler, Vegh, Janiszewski, & Quatman-Yates, 2015):
  - Physical Therapy improves gaze stability, balance and postural control and patient self-management of symptoms

Treatment for Various Populations

- Clinical Intuition & OT Theoretical Framework
Treatment for Various Populations

- More Research

Cognitive Rehabilitation After Traumatic Brain Injury: A Reference for Occupational Therapists (Stephens, Williamson, Berryhill, 2015)

Questions?
CDC Heads Up Program: http://www.cdc.gov/headsup/youthsports/

Summary/Overview of Concussion (Great for Journal Clubs!)

Residual Symptoms of Concussion
- Adults:
Full References

• Residual Symptoms of Concussion
  • Military

• Children
Full References

• Residual Symptoms of Concussion
  • Children (continued)

• OT Referrals after Concussion

• Missed Diagnoses
Full References

- **Athletes Perspective of Concussion**

- **Letter to the Editor**

Full References (continued)

- **Military**
  - **Treatment – Progressive Return to Activity**

  - **Treatment – OT Review (More Research Needed)**
Full References

• Treatment – Return to Work

• Treatment – PT for Pediatric Populations

• Treatment – Rest
Full References

• RTC in Youth – Coming Soon!

• Data & Statistics (unless otherwise cited):
  • National Hospital Discharge Survey (NHDS), 2010; National Hospital Ambulatory Medical Care Survey (NHAMCS), 2010; National Vital Statistics System (NVSS), 2010. All data sources are maintained by the CDC National Center for Health Statistics.
Questions?
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