The Role of SLPs in Concussion Management of School Age Children & Adolescents
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Metro Speech-Language Symposium

Part I: Background

TBI

- "Traumatic Brain Injury is an insult to the brain, not of degenerative nature but caused by an external physical force, that may produce a diminished or altered state of consciousness, which results in an impairment of cognitive abilities or physical functioning. It can also result in the disturbance of behavioral or emotional functioning. These impairments may be either temporary or permanent and cause partial or total functional disability or psychosocial maladjustment."

  - Brain Injury Association of America
Surprised?

TBI is considered a "Silent Epidemic."

Risk Factors (BIAA)

2010 data
Initial Determination of Severity

- Mild TBI
  - LOC <30 min
  - GCS 13-15
  - PTA < 24 hours
  - Altered mental status

- Moderate TBI
  - 30 min – 24 hours
  - GCS 9-12
  - + imaging findings (CT, MRI, EEG)

- Severe TBI
  - 24 hours +
  - GCS 3-8
  - + imaging findings (CT, MRI, EEG)

Major Types of mTBI

- Concussion – non focal movement
  - Most common type of BI
  - Blood vessels in brain stretch and twist
  - Often from whiplash, sports, blows to the head
  - Widespread dysfunction
  - 98% have no LOC

- Contusion – essentially a localized bruise to the brain
  - Structural imaging findings present

- Contusional-Contre-Coup
  - The brain hits two different sides of the skull
  - Essentially 2 contusion injuries
  - Rapid acceleration-deceleration accident

Severity of TBI ≠ functional level
Terminology

- **Concussion**
  - *Latin concutere* - "to shake violently"
  - *Latin concussus* - "action of striking together"

Concussion is defined as a complex pathophysiological process affecting the brain, induced by traumatic biomechanical forces. Several common features that incorporate clinical, pathologic and biomechanical injury constructs that may be utilized in defining the nature of a concussive head injury include:

1. Concussion may be caused either by a direct blow to the head, face, neck or elsewhere on the body with an "impulsive" force transmitted to the head.
2. Concussion typically results in the rapid onset of short-lived impairment of neurologic function that resolves spontaneously.
3. Concussion may result in neuropathological changes, but the acute clinical symptoms largely reflect a functional disturbance rather than a structural injury.
4. Concussion results in a graded set of clinical symptoms that may or may not involve loss of consciousness. Resolution of the clinical and cognitive symptoms typically follows a sequential course; however, it is important to note that, in a small percentage of cases, post-concussive symptoms may be prolonged.
5. No abnormality on standard structural neuroimaging studies is seen in concussion.

2008 Zurich Convention on Sport

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Dx concussion

<table>
<thead>
<tr>
<th>Historical</th>
<th>Systems evaluation criteria for grading</th>
<th>Grade 1</th>
<th>Grade 2</th>
<th>Grade 3</th>
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<td>Cantu</td>
<td>PTA &lt; 30 min, no LOC</td>
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<td>CO Medical</td>
<td>Confusion, No LOC</td>
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<td>Confusion, symptoms, LOC</td>
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Physiology

- Several things happen neurochemically with a concussion:
  - At the synaptic level, NMDA and Glutamate trigger neuronal depolarization with K⁺ efflux and Ca²⁺ influx.
  - Increased intracellular calcium triggers further neuronal depolarization and further release of excitatory neurotransmitters and still further release of K⁺ into the extracellular space.

More neurophysiology

- The neurons in the brain (not the glial cells) have a rapid increase in mitochondrial production of protein followed by a rapid prolonged decrease in production.
- Followed by 7-10 day metabolic depression (Leddy et al)
- Complete metabolic recovery at 30 days - functionally recovered at 3-15 days
- This decrease delays the protein production of the axonal sheath.
- So what?
  - 100 billion neurons in the brain w/o myelin = slow brains

Imaging

- Traditional structural brain scans look normal – This is important and can be problematic for an SLP.
- Functional: PET, SPECT, and DTI (Diffuse Tensor imaging)
- DTI measures water movement in the brain along axons – like a river
- Implicates neuronal activation
- Edema of corpus callosum at 6 days post

Image from US Army
Common complaints

- Headache
- Fatigue
- Increased sensitivity to light & noise
- Changes in sleep
- Decreased speed of thinking
- Memory changes (STM, WM)
- Word finding problems
- Decreased attention span
- Altered sense of smell/taste
- Mood swings
- Decreased appetite
- Word finding errors/rate
- Pragmatic changes
- Reading comprehension
- Writing cohesion
- Slowed reading rate
- Auditory comprehension

Language problems in mTBI

- Whatever was challenging pre-TBI, will be exacerbated post-TBI
Time for recovery

- Recovery - 90% of people will recover in the timeline of their age bracket.
  - This is critical because the normal brain should heal from a concussion, without any skilled services from you.
  - Of the remaining 10%, 90% of them will fully recover in 2 years.

Lingering effects- from a few days to ...

- The younger that you are the longer that your recovery is.
  - Average recovery time child 3-4 weeks (<10yo)
  - Adolescent 2-3 weeks (10-18).
  - College age 0-2 weeks (McCrea et al, 2003 JAMA)
  - Adult 0-1 weeks (Leddy et al).
  - This is only functional as neurochemical changes are still present
  - *Most sport related concussions resolve within 10 days.
  - Most non-sport within 3 months, ~10% take longer to resolve

Is this post-concussive? PCS

A. A history of head trauma that has caused significant rotational concussion.
B. Evidence from neurophysiological testing or quantified cognitive assessment of difficulty in attention (concentrating, shifting focus of attention, performing simultaneous cognitive tasks), or memory (learning or recalling information).
C. Three (or more) of the following occur shortly after the trauma and last at least 3 months:
  - Becoming fatigued easily
  - Disordered sleep
  - Headache
  - Vertigo or dizziness
  - Irritability or aggression with little or no provocation
  - Anxiety, depression, or lability
  - Changes in personality (eg, social or sexual inappropriateness)
  - Apathy or lack of spontaneity
D. The symptoms in criteria B and C have their onset following head trauma or else represent a significant worsening of preexisting symptoms.
E. The disturbance causes significant impairment in social or occupational functioning and represents a significant decline from a previous level of functioning.
F. The symptoms do not meet criteria for dementia due to head trauma and are not better accounted for by another mental disorder (eg, amnestic disorder due to head trauma, personality change due to head trauma, postconcussion syndrome).

(DSM-IV)
Reality

Good News
• 90% of people with post-concussive will fully recover within 2 years. (Remember that is 90% of 90% = 99%+)
• When you know what you are doing it is fun to treat because people get better rapidly.

Bad News
• Who is less likely to recover or have a prolonged recovery?
• We never know.
• Serial concussions is never good.
• Concussion on top of a concussion is never good.
• A significant trauma history is never good.
• Hist of LD, ADHD, headaches, other neurological d/o are redflags for protracted recovery.

When does speech get involved?
• Maybe immediately
• particularly if you specialize in TBI
• Rapid response for previous clients
• Clients/coaches/family members may call
• Referral 2 weeks to 2 years+ post injury.
• Many people are undiagnosed or misdiagnosed early on

Current concepts in concussion rehabilitation (Johnson, Bloom et al. 2004)

1. Prevent/Correct additional disability.
2. Enhance systems unaffected by the condition.
3. Enhance functional capacity of systems.
4. Use adaptive equipment to promote function.
5. Modify social/vocational environment.
6. Use psychological techniques to enhance pt performance and education.
PART II: SLP ROLE

Step 1: Educate
- When parents given early concussion education:
  - Recovery time of children is shortened
  - Parents report less anxiety and family stress (Ponsford et al 2001)
- You can make a big difference early on!
- Prevent additional disability
Parental Education: REST!

- Rest: (Cognitive & Physical)
  - THE BRAIN HEALS BEST AT REST!
  - Student likely will miss school
    - No school ≠ Run errands
  - Symptomatic kiddos should be at home
    - Max Time from school 5 days (case by case)
  - Avoid TV/video games = visual overwhelm
    - Nature shows can be okay
  - Low light, quiet place
  - Wear a hat/sunglasses
  - “Laziness” is important
  - No running, jumping, lifting weights

REST ctd.

- REST:
  - Eat: Protein is best for neuro-recovery
    - At least, any food 4-6 times per day
    - Talk with backpack program for support
  - Sleep: Increased sleep is necessary
    - Encourage napping
    - Often 10-20% increase in sleep
  - Time: Give parents a reasonable timeframe for recovery
Physical rest is also important to avoid...

Second Impact Syndrome

- A second injury when a first brain injury has not cleared
- Typically reported in adolescents (maybe only in adolescents, topping out at 24 yo)
- The injuries may have been minor
- Rapid brain swelling
- Severe compromising of cognitive state and yes death
- SIS will be avoided if children are not active when they are symptomatic

(You cannot have SIS in adults but 1 BI + 1 BI ≠ 3 BIs in terms of severity)

Jake Snakenberg Youth Concussion Act

- Colorado law passed in 2012 regarding youth sports
- Lead to the REAP project with Karen McAvoy
  - Mandating improved training for coaches
  - Medical release for RTP post-concussion
  - Quality training materials created
- 30+ states now have similar laws, but severe injuries continue
- CDE now has concussion guidelines
  - largely sport based
Free Educational Materials

Parents
- REAP manual
- CDC: Heads Up to Schools A Fact Sheet for Parents
- Tips for Acute Recovery – U of Colorado
- momsteam.com
- cokidswithbraininjury.com
- Children’s Hospital Colorado
- YouTube Video: Concussions 101, a Primer for Kids and Parents
  http://www.youtube.com/watch?v=zCCD52Pty4A

Staff
- REAP Manual
- CDC: Heads Up to Schools A Fact Sheet for Teachers, Counselors, & Professionals
- Concussion Return to Schools
- CDE: Concussion Guidelines
- BIAC: Brain Injury for Children & Youth: A Manual for Educators
- cokidswithbraininjury.com

Example sheets
Alcohol &
drug use

Alcohol has been shown repeatedly to slow down the healing of a brain. The research on marijuana is more ambiguous.

Primary concern? Preventing reinjury!

Step 2: Assess

To assess:
- Attention
- Processing Speed
- Memory
- Executive functions
- Linguistic functioning—word finding
- Reading comprehension

To listen for:
- 5% of PTSD
- Significant visual disturbance
- Referral for pain/HA
- Referral needs

Assess Red Flags
Common complaints post-conc

- Physical:
  - Headache, nausea, vomiting, dizziness, fatigue, blurred vision, sleep disturbance, visual dysfunction, sensitivity to light/noise, balance problems, transient neurological abnormalities, change in taste, smell, decreased appetite

- Cognitive
  - Attention, concentration, memory, speed of processing, judgment, executive control, planning, organization, insight, word finding

- Behavioral/emotional:
  - Depression, anxiety, agitation, irritability, impulsivity, aggression, lability

Step 2: Assess

- There is a problem discipline-wide with concussion assessment - SLP, neuropsych, psych etc
- In SLP, most used tools are: (Duff et al)
  - Ross Information Processing Assessment (RIPA) (71%)
  - Boston Diagnostic Aphasia Battery (BDAE) (53%)
  - Boston Naming Test (BNT)
  - Scales for Cognitive Assessment of TBI (SCATBI)
Review (and expansion) of problems in mTBI assessment

1. SLPs are using the wrong tools to assess TBI.
2. Pervasive tools like the ImPACT may not be sensitive to what we need to know – and are not functional for students.
3. Current tools are not sensitive to higher level deficits.
4. Cobbling together a battery would appear to provide the best solution at the present, but may lack breadth of symptomatology.
5. If you cobble together a broad enough compendium of tasks, you will ruin your client because of fatigue. You will see video samples of typical clients trying to complete evaluations.
6. If you spread out the assessment, in an acute client, from week 1- week 3 – they should have gotten better w/o your input – so you do not have a stable baseline.

Problems with long assessment
Pediatric assessment tools

- The rules of fatigue still apply!
- Tools reported by SIG 2 SLPs that they find of quality:
  - Test of Language Competence - Expanded (TLC-E)
  - Test of Memory and Learning (TOMAL-2)
  - Comprehensive Assessment of Spoken Language (CASL)
  - Pediatric Test of Brain Injury (may be too low level)
  - Detox – DTLA4
  - Wechsler Memory Scale
  - BRIEF- Peds
  - PASAT – Paced Auditory

Adult/HS/College Assessment

Adults
- WJIII Cog 6 & 16, 7, 12, 18
- WJIII Ach Story Retell 3, 12
- TOMAL 2 / RBMT
- APT – Attention Process Test (Sohlberg & Mateer) if APT for tx

HS/College Students
- I use tests that will work for accommodations for ETS/NCAA. These include:
  - WJIII Cog 6 & 16, 12, 18
  - WJIII Ach Story Retell 2, 12
  - Nelson Denny RT (Comprehension)
  - Conner’s CPE 5
  - WJIII Cog 2, 7, 9
  - WJIII Ach - Math Fluency

2nd client scoring

WJ III NU Computer and Profile Program, Version 3.0

Items based on grade 17.3 (4-year university)

- COG EFFICIENCY (Std - .3 - .4)
- PROCESS SPEED (Gs) - .3 - .4
- VISUAL–AUDITORY LEARNING - .3 - .4
- Numbers Reversed - .3 - .4
- Rapid Dot Naming - .4 - .5
- Rapid Picture Naming - .3 - .4
- Story Recall - .4 - .5
Until we have something else...

- Given the limitations of most of the standardized tests in our field, it is tempting to abandon the notion of standardized assessment for individuals with cognitive-communication disorders after TBI. (Turkstra, Coehlo, & Ylvisaker, 2002)
- Thus, rather than abandoning standardized tests, we should take an active role in developing instruments that meet our needs. (p.222)
- As of 2013, this has not yet happened for mTBI.

- Keep it short
- Functional
- You will not have time to do a comprehensive assessment
- Quick and Dirty

Step 3: Advocate

- Advocate for students with 504 accommodations
  - IEPs would be rare
- Typical accommodations:
  - Extended time for quizzes, assignments
  - Quiet, distraction free space for quizzes
  - Breaks throughout the day = rest in nurse’s office
  - Students have limited endurance/stamina
  - Separated/preferential seating
  - Reduced/eliminated homework/assignments
  - Alternate test format

Advocate

- Recommend realistic plan for the semester
- Decrease course load as appropriate
- Gradual return to class
  - May recommend withdrawal
- Write documentation to support services
  - Academic support services
  - No homework
  - Decreased homework
  - Staff education
  - Case Management
Step 1: Complete cognitive rest. This may include staying home from school or limiting school hours (and studying) for several days. Activities requiring concentration and attention may worsen symptoms and delay recovery.

Step 2: Return to school full-time.

Step 3: Light exercise. This step cannot begin until the athlete is no longer having concussion symptoms and is cleared by a physician for further activity. At this point the athlete may begin walking or riding an exercise bike. No weight-lifting.

Step 4: Running in the gym or on the field. No helmet or other equipment.

Step 5: Non-contact training drills in full equipment. Weight-training can begin.

Step 6: Full contact practice or training.

Step 7: Play in game. Must be cleared by physician before returning to play.

Walking the line

- Students need to allow their brain to rest but need to go to class as well
  - Teach them the signs of brain fatigue
  - Teach the teachers for when students cannot self-monitor
So how do I teach self advocacy?

- Concussions 101, a Primer for Kids and Parents
- Teach the hierarchy of Cognitive Overwhelm
- Distractibility/Inattention
- Headache
- Dizziness
- Vomiting
- Passing out

When someone can identify and manage their own triggers, many times they can be discharged.

“Metacognitive Strategy Instruction” (Lee, Henn, Sollberg & Wade 2012) Also Fatigue Chaper in BrainLash by Gail Denton
BREAKS!

- Schedule your students breaks
- PHYSICAL BREAKS!
  - Walk around, get something to eat, bathroom
  - Sitting and playing Angry Birds or checking email does not count
- With breaks, your clients' attentional resources are much greater.
  - Start with every 5-15 minutes.

Emotional support

- Concussions unrelated to sport are far more likely to result in emotional dysregulation.
- Consider PTSD/Anxiety d/o Jumpy, intrusive dreams, vigilant
- Trauma therapists with experience in TBI are key to recovery

*Students struggling emotionally pre-injury are more likely to need assistance. Just bc athletes are less likely to need emotional support – does not mean that they never do
Emotional support

- TBI Education
- You are not alone
- Coping with cognitive changes
- Education over normalcy of emotional lability
GREEN = GO

- PTSD
- Anxiety
- Depression
- Child endangerment
- Suicidality
RED = REFER

You will not be successful in your plan without trained support

Traditional SLP tools

- Skill Support
  - Reading Comprehension
  - Editing of papers
  - Organization
  - Smartphone
  - Scheduling
  - Technology to aid in the classroom
  - Your whole toolbox will be helpful - tailor to the student
  - Memory work
  - Multimodal learning

- Attention and memory training tools exist – e.g. CogMed and Lumosity – for children- I prefer using their actual schoolwork
  - “Almost never advice ‘busy’ work

Part III: Media
Chronic Traumatic Encephalopathy

- Dementia Pugilistica – “Punch Drunk”
- BU Center Study of Traumatic Encephalopathy BU/VA Drs. Anne McKee
  - 49 brains for pathological study
  - 65 yo control
  - Pro football player (Grimsley)
  - College football player
  - H.S. football player

Subconcussive blows

General considerations with athletes

- Be prepared for under reporting!
- Rest is not intuitive for a serious athlete
Questions?

Email at hardink@colorado.edu.

7 Step Return to Play

Step 1: Complete cognitive rest. This may include staying home from school or limiting school hours (and studying) for several days. Activities requiring concentration and attention may worsen symptoms and delay recovery.

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