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ACOFP / AOA's 122<sup>nd</sup> Annual Osteopathic Medical Conference & Exposition

**Joint Session with ACOFP, AOASM and AAO:**

## **Current Concepts in the Office Treatment of the Concussed Pediatric Athlete**

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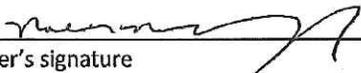
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\_\_\_\_\_  
Speaker's signature  
R. Robert Franks, DO, FAOASM

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# Current Concepts in the Office Treatment of the Concussed Athlete

R. Robert Franks, D.O., FAOASM  
Director Sports Concussion Institute  
Rothman Institute  
2017 OMED Conference  
Philadelphia, Pennsylvania  
October 9, 2017

## Objectives

- **To convince you that rest is no longer best**
- To discuss history clues in the office treatment of the concussed athlete
- To discuss the physical examination clues in the office treatment of the concussed athlete
- To discuss new treatment modalities and return to play criteria

## Objectives

- If you take home one point from this lecture, this is it
- **REST IS NO LONGER BEST, the new mantra is EXPOSE AND RECOVER**



## Objectives

- Per Berlin, multiple studies support gradually increasing activity before full contact risk
- Expose and recover
  - Cannot manage a concussion with a protocol
  - Identification of symptom categories should guide treatment
  - Cannot use a consensus statement or protocol alone

## Before Exam Begins

- Watch athlete walk to exam room
- CT Scan if done
- Computerized Neurocognitive Test Baseline and any post-tests
- SCAT5 and/or BESS or Sway Scores
- PPE of athlete with complete concussion history
- PHONE NUMBER OF YOUR ATC AT YOUR ATHLETE'S SCHOOL

## Before Exam Begins

- SCAT5 and Child SCAT5
  - Child is ages 5 to 12 and adolescent 13 to 18
  - Per Berlin, best instrument for sideline assessment
  - Utility decreases in 3 to 5 days
  - Baseline can be done and post tests should mimic baseline conditions
  - Helmet technology at present is not appropriate to assess concussion
  - Sideline review shows promise in assistance with diagnosis of concussion

## Parental Notification

- Understand often parents know less about concussion than often realized – even in the presence of good scholastic education
- Understand medical advice varies greatly on the internet, between practitioners and among cases themselves.

## Parental Notification

- Use best clinical judgment – symptoms often are delayed in onset
- Discuss school policy/state law requirements
- Use optometric examination
- Discuss time missed – one game is better than missing most of season
- Use examples parents can relate to – League of Denial, Real Sports
- Refer to NGB of patient's sport

## Key Historical Points

- Berlin 2017
  - SRC – Sport Related Concussion is new terminology
  - Concussion symptoms may be immediate or evolve over time
  - Extended concussion symptoms must not be explained by drug, alcohol, medication use, other injuries or other co-morbidities such as psychological conditions or coexisting medical conditions

## Key Historical Points

- According to Berlin 2017, condition of patient over first 24 to 48 hours dictates level of difficulty of patient recovery
- According to UPMC, on-field dizziness demonstrates patients with most protracted recovery
- Patients with history of migraines or mental health issues are more likely to have symptoms greater for one month

## Key Historical Points

- Concussion is underreported and often unrecognized
- Do not have to involve loss of consciousness
- Headache is most often reported symptom
- The adolescent brain recovers slower than the adult brain
- Emerging female predominance

## Key Historical Points

- If an athlete has had a concussion, they are 4-6 times more likely to have a second
- Subsequent hits, although lesser in nature, may produce worse symptoms
- Thus, a complete history of past concussions, with emphasis on LOC and type of amnesia is critical
- Athletes with co-morbid headache history or associated ADHD may need special consideration

## Key Historical Questions

- Does the athlete have pre-existing motion sickness
- How many head injuries has the patient had in the past?
- How did they occur?
- What type of symptoms did they have?
- How long did the symptoms last?
- Were they associated with LOC or amnesia, and what type?

## Key Historical Questions

- Do they have a pressure headache and does it get worse with school or exertion?
- Do they get dizzy with movement?
- Do they get fatigued at a certain point in the day?
- Are they more sensitive to light/noise?
- Are they more distracted?
- Are they have trouble falling/staying asleep?
- Are they more moody/irritable?

## Key Historical Questions

- Do they feel “foggy”?
- How many practices/competitions did they miss?
- Did the symptoms affect classes and their grades?
- How long did it take them to “feel themselves”?
- Did they have any “dings” or hits to chest, neck, or face that radiated to head that were unreported as concussion?
- Does the patient wear glasses or contact lenses and what type

## Symptom Categorization

- Rothman Concussion Program looks at categorization as modified from UPMC – one of most influential centers in the U.S.
- UPMC
  - Vestibular
  - Ocular
  - Cervicogenic
  - Anxiety/Mood
  - Cognitive/Fatigue
  - PTM (Post Traumatic Migraine)

## Modified UPMC Symptom Categorization

- Cervicogenic
  - Dysfunction to the cervical spine

## Modified UPMC Symptom Categorization

- Cognitive Symptoms
  - Attention Problems
  - Dysfunction
  - Fogginess
  - Fatigue
  - Cognitive Slowing

## Modified UPMC Symptom Categorization

- Emotionality
  - More emotional
  - Sadness
  - Nervousness
  - Irritability

## Modified UPMC Symptom Categorization

- Sleep Disturbance
  - Difficulty falling asleep
  - Sleeping less than usual

## Modified UPMC Symptom Categorization

- Vestibular
  - Ability of ophthalmologic and neurological systems and body (eyes, brain, and body) to work together

## Modified UPMC Symptom Categorization

- Ocular
  - Ability of ophthalmologic system to work appropriately
  - Are vergence and divergence, smooth pursuits, saccades, accommodation, convergence, VOR and VOR cancellation appropriate,

## UPMC Symptom Categorization

- Post-Traumatic Migraine
  - Headache with nausea and photo or phono phobia
  - Adolescence has risk for new onset migraine
  - Familial migraine history can be trigger for PTM in concussion patients

## Optometric Affectation

- Disturbances to the visual system secondary to concussion is known as Post Trauma Vision Syndrome
- Several problems in the visual system may result from PTVS

## Optometric Affectation

- Common disturbances with PTVS:
  - Tear Film Integrity
    - Distorted clarity or gritty sensation varies with blinking
  - Light Dark Adaptation
  - Light Sensitivity

## Optometric Affectation

- Common disturbances with PTVS :
  - Visual Field Integrity
    - Loss of portion of visual field
  - Accommodation
    - Constant or transient blur

## Optometric Affectation

- Most common PVTS afflictions:
  - Vergence 56.3%
  - Versions 51.3%
  - Accommodation 41%
  - Strabismus 25.6%
  - CN Palsy (Most Common III) 6.9%

## Optometric Conditions

- Optometric Issues
  - Convergence Insufficiency
    - Important for reading
    - Inability to use two eyes together as a team
  - Oculomotor Dysfunction
    - Permits accurate visual scanning and exploration
    - Important for reading and copying from board
    - Inability for eyes to together track a moving target and switch fixation from one target to another

## Optometric Conditions

- Optometric Issues
  - Accommodative Infacility
    - Important for academic efficiency and comfort to focus on an object – i.e. copy from blackboard
    - Inability to allow rapid and accurate shifts of attention from one distance to another with instantaneous clarity
    - Inability to allow student to maintain focus at reading distance

## Optometric Conditions

- Ophthalmologic Issues
  - Visual Intake-Visual Memory
    - Allows for optimal academic and athletic performance as affects proficiency in reading comprehension and spelling
    - Inability to obtain maximum visual information in the shortest possible time
    - Inability to retain this information over an adequate period of time

## Optometric Conditions

- Ophthalmologic Issues
  - Visual Motor Integration Deficit
    - Inability to analyze a visual stimulus, integrate that information with other systems, and produce a motor response (inappropriate eye-hand coordination)
    - Needed to produce written language
  - Fusional Instability
    - Inappropriate binocular function
    - Needed for near and distant visual tasks
    - Cause of blur or double vision

## Vestibular Symptoms

- Aural Symptoms
  - Tinnitus, fullness or hearing changes usually have worse prognostic recovery
  - May indicate a mixed central and peripheral vestibular disturbance that allows for slower and often incomplete recovery

## Physical Examination

Vitals  
Speech  
Gait analysis  
DTRs  
MS UE and LE b/l  
Sensation UE and LE b/l  
Cranial Nerve Examination

## Physical Examination

Romberg Test (Balance and Motor  
Coordination)  
Pronator Drift Test (Upper Motor Neuron  
Testing)  
Tandem Walk (Coordination)  
Heel to Shin (Balance and Coordination)  
Finger to Nose (Point to Point Coordination)  
**VOMS – Vestibular-Ocular Motor Screen**

## VOMS Physician Examination

### 1. Smooth Pursuit – Extra-ocular Muscle Testing

## VOMS Physician Examination

### 2. Saccades Testing

- Point to Point Discrimination in horizontal and vertical planes (Fingers 12 inches apart and patient looks between them for 15 seconds.)
- Look for latency of onset, speed, accuracy and conjugate movement. Test failure is delayed, inaccurate saccades or disconjugate eye movement.

## VOMS Physician Examination

3. Vestibulo-Ocular Reflex (VOR) – Gaze Stability
  - Ability to focus on stationary object while moving head without blurriness or dizziness
  - Do with examiner finger stationary and patient moving head side to side while fixating on stationary finger
  - Test in horizontal and vertical plane for 15 seconds
  - Look for inability to hold focus
  - With provocation, see decline in visual motor speed and reaction time

## VOMS Physician Examination

4. Visual Motion Sensitivity (VOR Cancelation)
  - Response to optokinetic stimulation
  - Patient focus on thumb as moves side to side following own thumb
  - Look for inability to follow fixated object
  - With provocation, see decline in visual motor speed and reaction time

## VOMS Physician Examination

### 5. Near Point Convergence Dysfunction Test

- Focus on writing on pen 6 cm from nose bridge
- Look for diplopia at greater than 6 cm

## VOMS Physician Examination

### 6. Test of Near Point Accommodation

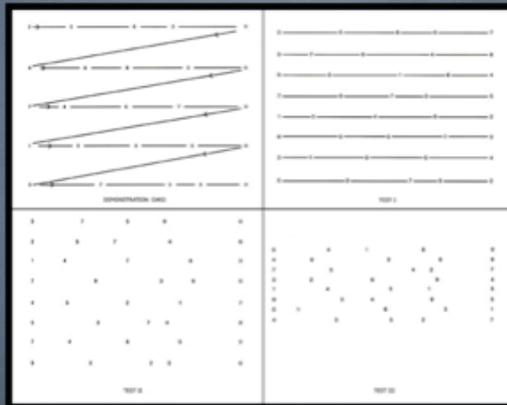
- Cover one eye
- Bring object to face
- Should accommodate – see clear at 15 cm
- Can fatigue system by bringing closer

## Ocular Assessment

- King Devick Test
  - Test of speed and accuracy of the visual system
  - Looks specifically at oculomotor function and saccades
  - Subject gets one practice trial and three test trials
  - Timing added from all three tests after concussion is often compared to baseline of time necessitated to take the test when not concussed

## Ocular Assessment

- King Devick Test



## Vestibular Examination

- BESS (Balance Error Scoring System)
  - 3 Tests 6 different balance conditions lasting 20 seconds
  - Stance settings – double leg, single leg, and tandem done on three surfaces – stable/firm and unstable/foam.
  - Score determined by amount of errors recorded during different balance conditions – one point for each error
  - Increased error reflect increased problems with balance and coordination post concussion

## Vestibular Examination

- Balance Testing
  - Patient self report (Activity Specific Confidence Scale or Falls Efficacy Scale)
  - BPPV Testing
  - **Sway Balance**
  - Testing Platform (i.e. Biosway)
  - Computerized Dynamic Posturography

## Classification

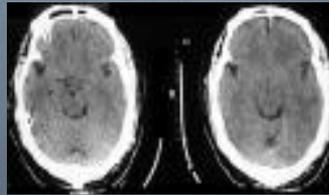
- Panel adopted that 80-90% of all concussions resolve in short 7-10 day period

## Imaging

- Vienna conference recognized that conventional neuroimaging is usually normal.
- Use in cases where there is suspicion of cerebral bleed, prolonged disturbance of conscious state, focal neurological deficit, seizure activity or persistent clinical or cognitive symptoms.

## Imaging

- CT usually test of choice as it will rule out an acute epidural or subdural hemorrhage.
- Athletes with concussion usually have normal CT scans and MRI scans.



## Imaging

- Additional Neuroimaging Considerations
  - MRI (with DTI)
    - Use of gradient echo, perfusion and diffusion weighted images better choice to distinguish structural brain abnormalities
    - High definition fiber tracking next stage of DTI – fails with crossing axons
  - PET Scan
    - Used often in concussion research but not yet standard of care
  - Magnetic resonance spectroscopy
  - Functional connectivity

## Imaging

- fMRI
  - Administration of MRI while patient undergoes cognitive challenge
  - See signaling in dorsolateral pre-frontal cortex corresponding to memory centers of brain
  - These areas often correspond with areas with altered brain metabolism seen with concussion research studies

## Neuropsychological Assessment

- Most often done in asymptomatic athletes to aid in return to play decisions.
- Acceptable to do in symptomatic child and adolescent athletes to determine management.
- Should not be sole basis for management or return to play decisions but aid in clinical decision making.

## Neuropsychological Assessment

- Should test cognitive domains of information processing, planning, memory, and switching mental set.
- Examples of tests include pen and paper tests, comprehensive protocols administered by neuropsychologists, and computerized test platforms.
- Ideally, there should be baseline pre-season testing followed by post-injury serial follow-up, especially true of elite athletes.

## Neuropsychological Assessment

- Gold standard remains formal neuropsychological examination by a trained neuropsychologist ideally trained in Sports Medicine
- Today, most often, computer neuropsychological testing is performed on athletes for rapid screen and to assess recovery.
- These tests include ImpACT, CogSports, Head Minders, and CNS Vital Signs to name a few



**ImpACT® Clinical v. 1.0.0**  
ImpACT Application

Event Type	Baseline	Post-intervention	Post-intervention	Post-intervention	Post-intervention
Date Tumor	06/10/2008	07/01/2008	08/01/2008	09/01/2008	10/01/2008
Local Coordinates	00170308	00170308	00170308	11001008	00170308
From Language	English	English	English	English	English
To Language	2.1.0.0	2.1.0.0	2.1.0.0	2.1.0.0	2.1.0.0
<b>Word Memory</b>					
Hit (percent)	9	11	10	9	10
Correct (percent correct)	7	12	10	10	9
Learning (percent correct)	87%	89%	89%	89%	89%
Hit (absol)	9	9	9	9	9
Correct (absol)	8	12	10	9	10
Correct (absol)	8	12	10	9	10
Default memory percent correct	87%	79%	87%	89%	79%
Total correct	90%	90%	79%	90%	89%
<b>Design Memory</b>					
Hit (percent)	9	8	10	9	10
Correct (percent correct)	7	10	10	9	11
Learning (percent correct)	87%	89%	89%	89%	89%
Hit (absol)	7	8	11	9	7
Correct (absol)	7	8	11	9	7
Correct (absol)	7	8	11	9	7
Default memory percent correct	87%	79%	87%	79%	89%
Total correct	85%	85%	89%	89%	89%
<b>Visual CV</b>					
Total correct (percent)	11	9	9	9	11
Total correct (absol)	119	109	103	114	102
Avg. correct RT (percent)	0.72	0.54	0.57	0.55	0.58
Avg. correct RT (absol)	7.2	5.4	5.7	5.5	5.8
Avg. correct RT (absol)	0.24	0.23	0.24	0.23	0.24
<b>Symbol Match</b>					
Total correct (percent)	37	37	37	37	37
Avg. correct RT (percent)	4.7%	4.4%	4.6%	4.7%	4.6%
Total correct (absol)	3	3	3	3	3
Avg. correct RT (absol)	0.08	0.08	0.08	0.08	0.08
<b>Color Match</b>					
Total correct	0	0	0	0	0
Avg. correct RT	0.07	0.15	0.07	0.09	0.14
Total correct	0	0	0	0	0
Avg. correct RT	0.00	0.00	0.00	0.00	0.00
<b>Three Letters</b>					
Total correct	4	2	3	3	4
Total correct (percent)	10	12	10	10	10
Percent of total trials correct	4.0%	8.0%	8.0%	8.0%	8.0%
Avg. time for trial	1.0	2.33	1.0	1.0	2.00
Avg. correct	7.0	14.0	10.0	11.0	11.0
Avg. correct per trial	0.7	1.0	1.0	1.1	1.1

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**ImpACT® Clinical v. 1.0.0**  
ImpACT Application

Event Type	Baseline	Post-intervention	Post-intervention	Post-intervention	Post-intervention
Date Tumor	06/10/2008	07/01/2008	08/01/2008	09/01/2008	10/01/2008
Local Coordinates	00170308	00170308	00170308	11001008	00170308
<b>Concepts Score</b>					
Memory (percent correct)	87%	79%	89%	89%	89%
Memory (absol)	87	79	89	89	89
Visual non-spatial composite	24.4%	30.0%	32.0%	31.4%	34.0%
Abstract non-spatial composite	5.7%	5.0%	5.0%	5.0%	5.0%
Abstract spatial composite	0	0	0	1	0
* Non-spatial composite scores are ImpACT version 1.0. All other composite scores are ImpACT version 1.1.					
<b>Conclusion Details</b>					
List of conclusions					
Background summary					
Abstract summary					
Conclusions (recommendations)					
Background (rationale)					
Tasks to complete					
CRM (cost of trial)					
Marketing plan					
Marketing timeline					
Description of agency and additional information					

The information provided in this report should be viewed as only one source of information regarding the efficacy of the study. It is not intended to be used as the sole basis for clinical decisions. The information provided in this report is intended to be used as a reference only and should not be used as the sole basis for clinical decisions. The information provided in this report is intended to be used as a reference only and should not be used as the sole basis for clinical decisions. The information provided in this report is intended to be used as a reference only and should not be used as the sole basis for clinical decisions.

Consent to participate in this study should be obtained from all participants. The confidentiality of the information should be maintained. The information provided in this report is intended to be used as a reference only and should not be used as the sole basis for clinical decisions.

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## ImPACT Critical Numbers

- Verbal memory – 90
- Visual memory – 80
- Visual Motor Speed Composite – 40
- Reaction Time – less than 0.55
- Symptom Score – 9

## ImPACT RCI Scores

- Verbal memory – greater than 8.75
- Visual memory – greater than 13.5
- Visual Motor Speed Composite – greater than 4.98
- Reaction Time – greater than 0.06
- Symptom Score – greater than 9.6

**ImPACT® Clinical Report**  
ImPACT Applications

Exam Type:	Baseline	Post-concussion	Post-concussion	Post-concussion	Post-concussion
Date Tested:	02/04/2005	07/06/2005	08/31/2005	10/21/2005	10/20/2005
Last Concussion:	05/11/2005	05/11/2005	03/31/2005	11/01/2004	04/11/2005
<b>Symptoms</b>					
Headache	4	3	0	3	1
Nausea	3	1	0	3	0
Vomiting	0	0	0	0	0
Balance Problems	2	1	1	2	0
Dizziness	2	1	1	1	0
Fatigue	3	3	0	4	1
Trouble falling asleep	0	0	0	0	0
Sleeping more than usual	5	1	0	4	0
Sleeping less than usual	0	0	0	0	0
Darkness	5	3	0	4	1
Sensitivity to light	4	1	0	0	0
Sensitivity to noise	3	1	1	0	0
Irritability	1	1	0	0	0
Swarm	2	0	0	2	3
Nervousness	0	0	0	0	2
Feeling more emotional	0	0	0	0	0
Numbness or tingling	0	0	0	0	0
Feeling slowed down	5	3	1	5	1
Feeling mentally foggy	4	2	1	2	0
Difficulty concentrating	5	3	1	2	1
Difficulty remembering	4	1	0	1	1
Visual problems	5	0	0	0	0
<b>Total Symptom Score</b>	<b>57</b>	<b>23</b>	<b>0</b>	<b>35</b>	<b>12</b>

**ImPACT® Clinical Report**  
ImPACT Applications

<b>Baseline</b>	Hours spent last night:	10.0
	Medication:	
	Subject comments:	INSTRUCTIONS: The instructions were clear.
	Supervisor comments:	COMPUTER: Subject was fine except sensitive when typing in info at the beginning.
		ENVIRONMENT: environment was good.
<b>Post-concussion</b>	Hours spent last night:	6.0
	Medication:	
	Subject comments:	
	Supervisor comments:	
<b>Post-concussion</b>	Hours spent last night:	5.0
	Medication:	
	Subject comments:	
	Supervisor comments:	
<b>Post-concussion</b>	Hours spent last night:	7.0
	Medication:	alprazolam
	Subject comments:	
	Supervisor comments:	
<b>Post-concussion</b>	Hours spent last night:	7.0
	Medication:	amblypyline
	Subject comments:	
	Supervisor comments:	

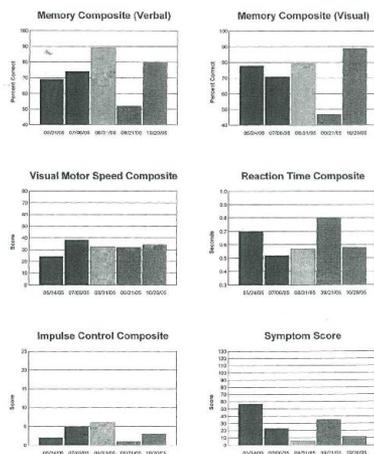
The information provided by this report should be viewed as only one source of information regarding the athlete's level of symptoms. Symptoms of concussion should be discussed with the clinician who generated the ImPACT test should be based on an evaluation by medical personnel in accordance with usual and standard medical practice. If an athlete is suspected of suffering a mild traumatic brain injury or concussion, this individual should be evaluated by medical personnel and should be followed carefully for the emergence of symptoms.

Consultation is recommended to help facilitate proper interpretation of the outlined test scores. For consultation please feel free to contact Dr. Abby Collins or Dr. George Colten at the University of Missouri Center for Sports Medicine. To ensure proper interpretation of the test data, there will be no charge for the initial post injury consultation.

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ImPACT® Clinical Report  
ImPACT Applications



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## Treatment Goals

- Keys are to do the following:
  - Recognize, Remove, Re-evaluate, Rest, Rehabilitation, Refer, Recover, Return to Sport, Reconsider, Residual Effects, and Risk Reduction
- Prevent Second Impact Syndrome
- Prevent cumulative effects of concussion
- Prevent Post Concussion Syndrome
- Alleviate symptoms

## Treatment Goals

- Per Berlin, clinicians must determine whether extended recovery in some patients is due to premorbid maladies, downstream effects of SRC, or unrelated challenges while being mindful of the potential for repeat injuries when returning patients to sports too early
- These conditions include chronic migraine, anxiety, post traumatic stress disorder, attention problems, and sleep dysfunction

## Treatment

- Per Berlin, the physiological time of recovery may outlast the time for clinical recovery

## First Line Overall Treatment

- Athlete should be placed at complete mental and physical rest
  - Includes
    - NO PE
    - NO tests/quizzes/projects
    - No video games
    - No texting
    - Limited computer
    - No concerts
    - No loud indoor events
    - No long TV watching or reading

## First Line Overall Treatment

- 3 meals a day with heavy emphasis on protein ingestion
- Increased hydration – 80 oz per day
- Sleep 7 to 9 hours per night – no naps, electronics in bedroom
- Exercise – start with walking

## UPMC Modified Symptom Categorization Treatment

- Vestibular
  - 60 % of cases
  - VOR and VMS are provocative showing decline in visual motor speed and possibly reaction time on ImPACT
  - Propensity to become anxious
  - See more dynamic vestibular symptoms than static

## UPMC Modified Symptom Categorization Treatment

- Vestibular
  - Treatment
    - Vestibular Therapy
    - Exposure/Recovery
    - Behavioral Management
    - Exertion
    - Medications
      - Klonopin, SSRIs, Tricyclics, Sleep Meds

## UPMC Modified Symptom Categorization Treatment

- Anxiety/Mood
- Stress – see onset as quickly as 2 weeks and worsens with rest – highly underreported
  - immediate consideration of referral
    - Continued symptom inventory
    - Cannot turn off thoughts
    - Increased symptoms if think of symptoms
    - Refusal to attend social activities
    - Continued parental questioning of symptoms
    - Sleep problems are often co-morbid

## UPMC Modified Symptom Categorization Treatment

- Anxiety/Mood
- VOMS nil or mildly provocative – if vestibular overlay treat vestibular signs first
- Often see in presence of great ImPACT scores but high symptom complaints

## UPMC Modified Symptom Categorization Treatment

- Anxiety/Mood
- Treatment
  - Therapy (Cognitive Behavioral Therapy)
  - Exposure
  - Exertion
  - Behavior Regulation – diet, exercise, hydration, stress
  - Medications
    - SSRIs
    - Benzos

## UPMC Modified Symptom Categorization Treatment

- Ocular
  - 42 to 69 % of patients report this
  - Frontal headache, tired behind eyes
  - Problems in math and science
  - End of day fatigue
  - See issues with near point convergence, accommodation, pursuits, saccades on VOMS
  - See decrease in verbal memory, visual motor speed composite and reaction time
  - Problem is in encoding not retrieval

## UPMC Modified Symptom Categorization Treatment

- Ocular
  - Treatment
    - Vestibular Therapy
    - Vision Therapy – may have to do visual therapy before vestibular if extremely symptomatic
    - Exertion Therapy
    - ? Treatment for stress/anxiety

## UPMC Modified Symptom Categorization Treatment

- Cognitive/Fatigue
  - 52% of patients report
  - Worsened with learning disability/ AD/HD co-morbidity
  - Headache increases as day evolves
  - More fatigued at end of the day
  - VOMS grossly normal
  - Global decrease in ImpACT and worsens as test continues
  - Deficits with retrieval as opposed to encoding

## UPMC Modified Symptom Categorization Treatment

- Cognitive/Fatigue
  - Treatment
    - Educational accommodations (Breaks, etc.)
    - Cognitive Rehabilitation
    - Medications
      - Amantidine
      - Stimulants
      - Sleep Aids

## UPMC Modified Symptom Categorization Treatment

- Cervicogenic
  - Caused by axial load and
    - Upper cervical – aa, oa – rotatory forces
    - Lower cervical – rotational and side bending forces
  - Look at flexion, extension, right and left rotation, right and left side bending
  - Look at neck strength

## UPMC Modified Symptom Categorization Treatment

- Cervicogenic
  - Treatment
    - PT
    - TENS
    - Muscle Relaxers
    - Thoracolumbar support bracing
    - Manipulation
    - Trigger point injections
    - Facet injections
    - Epidurals/Nerve Blocks

## UPMC Modified Symptom Categorization Treatment

- Post Traumatic Migraine
  - Headache with nausea and photo/phono phobia
  - Often associated with stress
  - VOMS normal
  - Verbal and visual memory deficits, if vestibular involved as well, see deficiencies in visual motor speed as well

## UPMC Modified Symptom Categorization Treatment

- Post Traumatic Migraine
  - Treatment
    - Diet, Hydration, Stress, Exercise regulation
    - Tricyclics, Propranolol

## Vestibular Therapy

- Helps with dizziness, vertigo, balance, and vision/visual discrimination associated with concussion
- Uses current VT, PT and OT maneuvers
- May be used alone or as adjunct therapy

## Vestibular Therapy

- Mean duration of vestibular therapy in significant concussions can be as long as 33 days

## Psychological Treatment

- Definitive application in concussion.
- Significant benefit to treat affective symptoms such as depression often associated with concussion.
- Early recognition and intervention is key in treatment.

## Cognitive Therapy

- Written as last part of neuropsychological assessment
- Can be done in out-patient or school setting
- Breaks cognition into component parts and uses cues and retraining to assist and reteach learning
- May assist in shaping IEP or 504 plans

## Cognitive Behavioral Therapy

- Often used with co-morbid mood disorders
- Psychosocial intervention focusing on personal coping strategies to solve current problems and change unhelpful patterns in behavior, cognition and emotional regulation
- Best done with therapist but there are computer programs available

## Optometric Treatment

- Treatment may be intra-office or via home
- Can often be done with spectacle use and computers

## Optometric Treatment

- Treatment Modalities
  - Anti-refractive coating and corrective lenses
  - Correcting prism
    - High convergence excess
    - Vertical deviations
    - Fixation disparities
    - Selective Occlusions

## Optometric Treatment

- Treatment Modalities
  - Yoked Prism
    - Visual Midline Shift Syndrome
    - Progressive Supra Nuclear Palsy
    - Visual Field Defects
    - Certain Visual Perceptual Processing Defects
    - Ocular Motion Restriction

## Optometric Treatment

- Treatment Modalities
  - True Optometric Rehabilitation
    - Improve convergence and eye teaming abilities
    - Improve accommodative ability
    - Improve visual tracking skills
    - Improve short term visual memory
    - Done via intra office exercises using charting, tracking and computers and can also be then transferred to home computer

## Pharmacological Treatment

- Should be performed by those experienced in treating concussion.
- Should be done in one of two of following instances:
  - Control of specific symptoms in concussion.
  - To modify the underlying pathophysiology of concussion to shorten the symptom duration.

## Pharmacological Treatment

- NSAIDs should be avoided as they can cause rebound headache. Use Acetaminophen only in those under 18.
- Ultracet can be used in those over 18 and without co-morbid seizure disorder.
- Consider the use of vitamin therapy
  - B2
  - Mg
  - Coenzyme Q
  - Vitamin E

## Somatic Symptoms

- Post Traumatic Migraine
  - Propranolol (OLU)
  - Verapamil (OLU)
  - Amitriptyline (OLU)
  - Triptans
  - Lexapro
  - Zoloft

## Emotional Symptoms

- SSRIs
  - Lexapro
  - Zoloft
- Ativan

## Cognitive Symptoms

- Amantadine (Symmetrel) (OLU)
- Concerta (OLU)
- Strattera (OLU)

## Sleep Symptoms

- Melatonin
- Benadryl
- Vistrail
- Trazodone
- Ambien

## Vestibular Symptoms

- Klonopin

## Return to School

- Step One
  - Daily activities at home that do not give symptoms such as testing, reading, etc. Goal is gradual return to typical activities
- Step Two
  - School activities such as homework or reading. Goal is increase tolerance to cognitive work

## Return to School

- Step Three
  - Return to school part time with gradual introduction of schoolwork. Goal is to increase academic activities
- Step Four
  - Return to school full time with gradual progression to full day of work. Goal is return to full activities and make up missed work

## Educational Component

- Guidance Office, Child Study Team and teachers should be made aware of patient's concussed status
  - Student may have difficulty concentrating or paying attention
  - Student may have difficulty remembering older material or learning new material
  - Longer time may be needed for tasks, tests and assignments
  - There is often greater irritability and decreased ability to cope with stress
  - Symptoms increase with schoolwork and testing
  - Premorbid ADD, ADHD, depression or anxiety may worsen

## Educational Component

- No or adaptive PE as conditions warrant
- Remove from loud environment – i.e. cafeteria
- Allow sunglasses and ear plugs for photophobia and phonophobia
- Education assistance
  - Extra Help
  - Extra Time
  - 504 Plans/IEP
  - Change in class difficulty level
  - Alternative testing
  - Limited computer use
  - Important to differentiate comprehensive vs. computational dysfunction (i.e. inability to focus or converge vs. true cognitive dysfunction)

## Educational Component

- Test Taking
  - Extra time to complete tests (Time and a half)
  - Testing in quiet environment
  - Allow testing across multiple sessions
  - Reduce test length
  - Eliminate tests when possible
  - Reformat free response to multiple choice tests or use of cueing
  - Highly demanding activities increase symptoms and learning is not as effective or rapid with concussion

## Educational Component

- Note Taking
  - Obtain copies of class notes, powerpoints, outlines, or photocopied student notes before class
  - Concussion makes multitasking skills difficult and increases vestibular and optometric symptoms
  - Use of iPad to enlarge notes and powerpoints

## Educational Component

- Workload Reduction
  - Decrease amount of make up work, class work and homework by 50 to 75 %
  - Shorten tests and projects
  - Decrease length of essays
  - Do every other problem in a problem set
  - Only test relevant topics
  - Increased memory problems and decreased speed of learning are present with concussion. Pushing through often worsens symptoms and delays recovery

## Educational Component

- Breaks
  - Break according to symptom onset
    - Head down at desk for minimal symptoms
    - Report to Nurse's Office for severe symptoms

## Educational Component

- Extra Time
  - Allow student extra time to complete tests, quizzes and assignments and allow to turn in late
  - Concussion symptoms can be erratic and may be increased at certain times requiring cessation of activity and turning in assignments late

## Educational Component

- Attendance Restrictions
  - Consider half days alternating between AM and PM classes
  - Consider homebound education for severely concussed

## Return to Play

- Never return player who still has concussive symptoms.
- Patient requires physical and cognitive rest
- This includes activities that require concentration and attention
  - School Work
  - Video Games
  - Text Messaging
- If symptoms have resolved with rest, test patient with exertion.

## Return to Play

- Player should proceed stepwise.
- If post-concussive symptoms recur, the athlete should drop back to previous asymptomatic level and attempt progression again in 24 hours.
- Should not be taking any pharmacological agents that may effect or change symptoms of concussion.
- Should have neuropsychological testing return to baseline

## Return to Play

- No activity
  - Complete rest
  - Recovery Phase
- Once asymptomatic for 24 hours, proceed to step 2

## Return to Play

- Light aerobic exercise
  - Walking
  - Swimming
  - Stationary Cycling
    - All Less Than 70 % MPR
    - No Resistance Training
- – Increase HR

## Return to Play

- Sport-specific training
  - Skating drills in ice hockey
  - Running in soccer
  - No head impact activities
  - Add movement

## Return to Play

- Noncontact training drills
  - Progression to more complex training drills
    - Passing drills in football
    - Passing drills in hockey
    - May begin progressive resistance training
  - Exercise, coordination, and cognitive load

## Return to Play

- Full-contact training after medical clearance
  - Restore confidence and assess functional skills by coaching staff
- Return to game play

## Return to Play

- No child or adolescent athlete, including the collegiate athlete, no matter the skill level, should return to play on the same day.
- Some NFL studies have shown no risk of recurrence or sequela with same day RTP in presence of physicians with experience and rapid neurocognitive assessment.
  - However, full clinical and cognitive recovery must occur before consideration of RTP

## Education

- Imperative that coaches, players and parents understand the medical issues involved in concussion.
- Athletes must know of consequences of premature return of play.
- Athletes must also know that not every concussion results in automatic removal from sports.

## Heads Up Concussion Kits

[http://www.cdc.gov/ncipc/tbi/Coaches\\_Tool\\_Kit.htm](http://www.cdc.gov/ncipc/tbi/Coaches_Tool_Kit.htm)



CDC Concussion Tool Kit

- <http://www.bianj.org> Education
- <http://impacttest.com>
- [www.concussionwise.com](http://www.concussionwise.com)
- [www.sportsconcussions.org](http://www.sportsconcussions.org)
- [www.cdc.gov/concussion](http://www.cdc.gov/concussion)
- <http://www.thinkfirst.ca>



- Good sites for athletes to check for understanding of concussion.

## Medicolegal Aspects of Concussion

- Currently all 50 states have some kind of concussion legislation
- It is imperative that you know the specifics concerning the laws of the state(s) in which you practice.
- Washington state was first state with an official concussion law – The Lystedt Law

## Medicolegal Aspects of Concussion

- Schools are encouraged to have SRC Policy that includes the following:
  - Education on SRC prevention and management for teachers, staff, students, and parents
  - Should offer academic accommodation and support to athletes with SRC
  - Encourage regular medical follow up to monitor recovery and return to school
  - Provide for temporary absence from school after SRC

## Prevention

- Mandate helmet use in skiing and snowboarding
- Questionable effect of mouthguards
- Decrease body checking in youth hockey
- Injury Preventive Strategies
  - Vision training in NCAA football
- Knowledge translation (KT) is critical

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## Thank You

