Objectives

- Describe the pathophysiology of a concussion
- Describe the evidence-based outcomes from concussion injuries
- Describe return to play guidelines
- Describe the optometric evaluation
- Describe the interprofessional team and reasons for targeted referrals

CASE

CASE - HPI

- 20 year old female soccer player
- Trauma: On field injury 09/03/13, no LOC
- Vision complaints: Blurry vision, Photophobia
- Physical complaints: Right sided head pain, Dizziness
- Cognitive or behavioral changes: Irritable, fatigue
- OH/FOH: Negative
- MH/FMH: Neck restriction SCM
- Meds: Medrol Dose Pack, DHA 1000mg po daily
- Alls: NKDA

CLINICAL FINDINGS

- Normal visual acuities 20/20, both eyes
- Ocular discomfort on supraversion, both eyes
- Normal ocular health exam
- Normal visual field study
Management

• What else could you do?
• Did this patient have a concussion?
• Should this patient return to play?
• Should this patient return to school?
• Would you refer this patient and where?

CONCUSSION

CDC Definition:

“A concussion is a type of traumatic brain injury, or 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.”

Epidemiology

• 38 million children in organized sports in US annually\(^1\)
• 170 million adults in physical activities\(^2\)
• 1.6 to 3.8 million sports/recreation concussions\(^3,9\)
• 5.3 with TBI-related disability\(^3\)
• Many do not seek medical advice\(^3,4\)
  -- Rapid onset, resolve, unrecognized, unreported\(^1\)
  -- Estimated 85% undiagnosed\(^5,6\)

CONCUSSION

• Can’t see a concussion and some athletes may not experience and/or report symptoms until hours or days after the injury.
• Any change in the athlete’s behavior, thinking, or physical functioning.
• Overall, the activities associated with the greatest number of TBI-related ED visits included bicycling, football, playground activities, basketball, and soccer.\(^10\)

BIOMECHANICS

• Linear acceleration
• Rotational forces
• Blast injuries

Pathophysiology

• Axonal stretching
• Neuronal injury
• Ionic imbalance
• Neurotransmission disrupted
• Energy crisis
• 1\(^{st}\) concussion – metabolic imbalance
• 2\(^{nd}\) concussion events – prolong metabolic normalization
Risk factors

- Age
- Gender
- Type of sport
- Level of play

Most reported childhood concussions?

- American football
- Baseball/softball
- Basketball
- Cheerleading
- Gymnastics
- Ice/Field hockey
- Soccer
- Skiing/Snowboarding
- Volleyball
- Wrestling

Most reported childhood concussions?

- American football (boys)
- Baseball/softball
- Basketball (girls)
- Cheerleading
- Gymnastics
- Ice/Field hockey
- Soccer (girls)
- Skiing/Snowboarding
- Volleyball
- Wrestling

State Laws

- Beginning in 2009, the state of Washington passed the first concussion in sports law, called the **Zackery Lystedt Law**. One month later, Max’s law passed in Oregon. In total, between 2009 and 2012, 43 states, and the District of Columbia, passed laws on concussions in sports for youth and/or high school athletes (often called Return to Play laws).

- **National Conference of State Legislatures**, created online maps to track and update concussion in sports laws by state.

CA LAWS

**AB 1451 (2012)**
Added concussion education to the required first aid training of every high school sports coach. Coaches will learn the basic signs and symptoms of concussions and the appropriate response.

**AB 25 (2011)**
Requires a school district to immediately remove an athlete from a school-sponsored athletic activity if he or she is suspected of sustaining a concussion or head injury. Students are prohibited from returning to play until he or she is evaluated by, and receives written clearance from, a licensed health care provider.
Remove from play: 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”

Remove from play: 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

Remove from play: SCAT/SCAT2

• Sports Concussion Assessment Tool
• Standardized for athletes 10yrs and older
  – Symptom
  – Physical signs
  – Glasgow coma scale
  – Sideline score (Maddocks)
  – Cognitive assessment (SAC)
  – Balance (BESS)
  – Coordination
• Preseason (Baseline for athletes in contact/collision sports)
• 20 mins, performed by medical professional
• No validated, variable, subjective

Remove from play: KING-DEVICK

• Baseline comparison
• < 1min sideline screening
• Objective, can be administered by non-medical professional
• Needs large-scale test norms

King-Devick Test

King-Devick Test
King-Devick Test

“When in doubt ...sit them out”

- Second Impact syndrome
- “Keeping quiet can keep you out of the game”
- “If you didn’t head the ball, you were like the weakest link”
- Girls sidelines by soccer concussions: http://video.msnbc.msn.com/rock-center/47364208

Symptom survey: ACE

- CDC recommended tool
- Acute Concussion Evaluation
- Evidence-Based protocol

Neurocognitive function: ImPACT

- Immediate Post-Concussion Assessment and Cognitive Testing
- Baseline neurocognitive testing comparison
  - Concentration
  - Short term memory
- Sway Balance App (medical device)
- Normative data 10-59 yrs

Return to play

1. Educate Coaches, Parents, and Athletes
2. Remove Athlete from Play
3. Obtain Permission to Return to Play: An athlete can only return to play or practice after at least 24 hours and with permission from a health care professional. They should be symptom-free.

Return to school

Section 504 Plan
Plan for gradual return to school
- Time off from school
- Shortened day
- Shortened classes (i.e., rest breaks during classes)
- Rest breaks during the day
- Allowances for extended time to complete coursework/assignments and tests
- Reduced homework/classwork load (it is best to specify for teachers the percent of workload that the student can reasonably handle, e.g., 50% homework load)
- No significant classroom or standardized testing at this time
Post-concussion sequelae

Affect changes:
• Increased lability
• Anger control (with frontal lobe injuries)
• Impulsivity (with frontal lobe injuries)
• Inappropriate behavior (with frontal lobe injuries)

Cognitive deficits:
• Memory difficulty
• Executive function

Post-concussion sequelae - Sensory

• Hearing deficits
  — Loss
  — Phonophobia
  — Tinnitus
• Speech impairments
• Dizziness/nausea

Post-concussion sequelae - Motor

• Restricted neck movements
• Restricted lateralized mobility of upper and/or lower extremities
• Gait disturbance
• Tremors

Post-concussion sequelae - Visual

• Accommodative Dysfunctions (in pre-presbyopic patients)
• Dry Eye
• Versional Oculomotor Dysfunctions
• Vergence Oculomotor Dysfunctions
• Visual-Vestibular Disturbances
• Photosensitivity
• Visual Field Defects

Neuro-Optometric evaluation

• Case/Trauma History
• High yield HPI inquiry
• Medication review
• Refraction
• Accommodation
• Versions
• Vergence
• Visual fields
• Ocular health with dilation
  — Visual processing speed
  — Visual spatial
  — Visual evoked potentials
  — Gait assessment
  — Physical exam
  — ICD-850.0, 850.1, 850.0, 959.01

Improve Communications

• Allow more time
• Give written materials
• Offer access to a quiet, low-stim waiting area
Interdisciplinary Rehabilitation Team

- Physiatrist
- Neurologist
- Internist
- Sports Medicine
- Psychiatrist/Psychologist
- Neuropsychologist (i.e., cognitive therapist)
- Physical Therapist/Vestibular Therapist
- Occupational Therapist
- Speech Therapist
- Optometrists

Case wrap up

- Accommodative testing, DEM/K-D, VEP, Gait, MLSS
- Concussion present
- Hold return to play
- Return to school with Near Rx, Tinted Rx and Binasal wedge, taper in 1 month
- Physical therapy and Consult report to Neurology

Prevention

- Exposure
- Equipment
- Education
  - CDC HEADS UP Programs
  - Athletes, coaches, parents, teachers, med professional
  - 40% return to play prematurely

Conclusion

- Not just bumps and bruises
- Evolving guidelines
- Importance of baseline testing
- Tools for decision making
- Vision based evaluation
- Referrals

THANK YOU

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References

Please complete your session evaluation using EyeMAP™ online at [http://eyemap.cistems.net](http://eyemap.cistems.net).

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