

St. Charles Presents

DOC TALKS

GET ANSWERS

CONCUSSION

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Medical Advisory committee for CDC RTL GRANT, OSAA and Board Member of OCAMP

OBJECTIVES

- WHAT IS CONCUSSION
- WHAT IS SECOND IMPACT SYNDROME
- WHAT IS CTE OR CHRONIC TRAUMATIC ENCEPHALOPATHY
- DESCRIPTION OF CURRENT CENTRAL OREGON CONCUSSION MANAGEMENT
- KEY PLAYERS
- DO I NEED A BASELINE IMPACT OR OTHER BASELINE?
- OUTCOMES
- CASE STUDY



EPIDEMIOLOGY

- APPROXIMATELY 1.74 MILLION PEOPLE SUSTAIN A TBI IN THE US EACH YEAR
- HIGH INCIDENCE IN FOOTBALL, HOCKEY, SOCCER, BOXING
- UP TO 20% OF ATHLETES IN A CONTACT SPORT EXPERIENCE A CONCUSSION
- > 80% OF ATHLETES WITH A PAST CONCUSSION DID NOT RECOGNIZE IT AS SUCH
- EVANS, R. W., FAANCLINICAL, & BAYLOR, N. (2017, JANUARY). CONCUSSION AND MILD TRAUMATIC BRAIN INJURY. RETRIEVED FEBRUARY 5, 2017, FROM [HTTPS://WWW.UPTODATE.COM/CONTENTS/CONCUSSION-AND-MILD-TRAUMATIC-BRAIN-INJURY?SOURCE=SEARCH_RESULT&SEARCH=CONCUSSION&SELECTEDTITLE=1~50#H1378019](https://www.uptodate.com/contents/concussion-and-mild-traumatic-brain-injury?source=search_result&search=concussion&selectedtitle=1~50#H1378019)



CAUSES OF TBI IN OLDER ADULTS

- **#1. FALLS:** FOR AGES 65-74, FALLS ACCOUNT FOR APPROXIMATELY 55% OF TBIS, BUT FOR AGES 75-85 FALLS ACCOUNT FOR APPROXIMATELY 75% OF TBIS.
- **#2. MOTOR VEHICLE ACCIDENTS (MVAS):** MVAS ACCOUNT FOR A GREATER PERCENTAGE OF TBIS IN INDIVIDUALS AGES 55-64, BUT THIS PERCENTAGE DECREASES AS INDIVIDUALS GET OLDER, LIKELY DUE TO LESS DRIVERS. FOR AGES 75 AND OLDER, MVAS ACCOUNT FOR LESS THAN 20% OF TBIS.
- **#3. UNKNOWN CAUSES:** AS MUCH AS 20% OF TBIS IN OLDER ADULTS ARE FROM UNKNOWN CAUSES.
- **#4. ASSAULTS:** ASSAULTS ACCOUNT FOR 1% OF TBIS IN OLDER ADULTS.

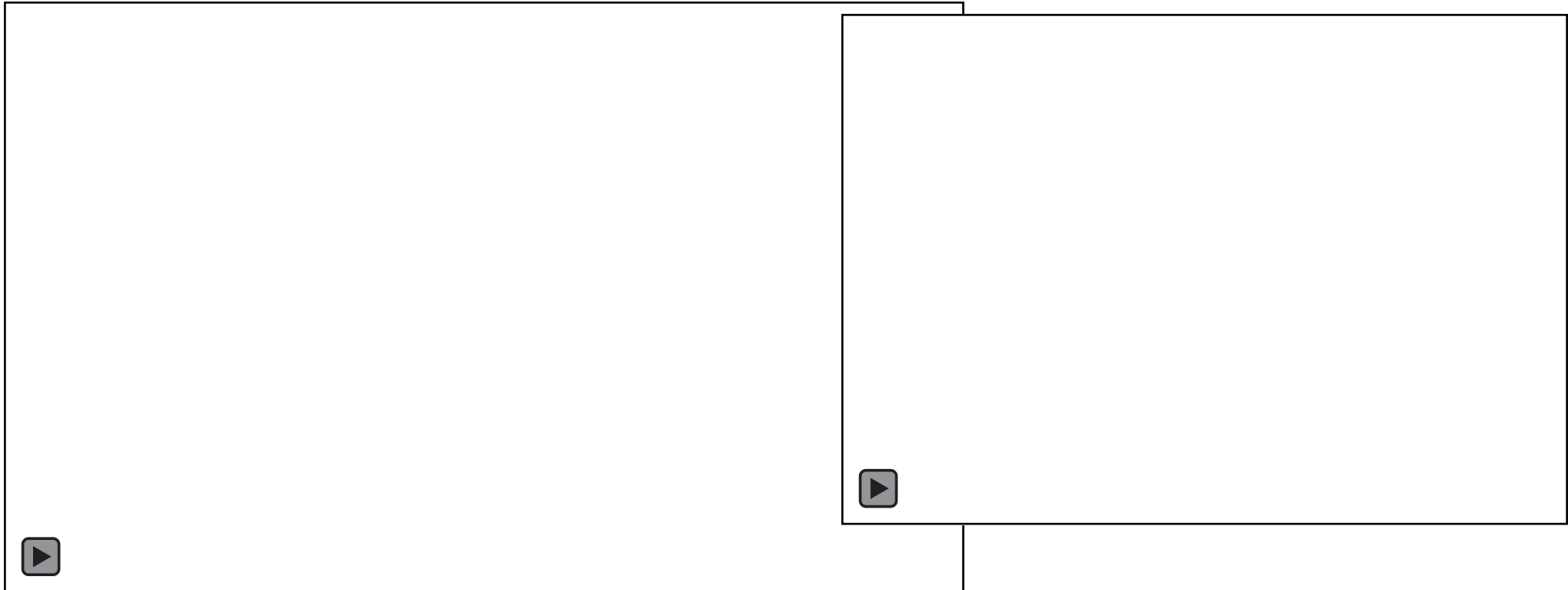
Definition of concussion

- **CDC** – a type of traumatic brain injury (TBI) caused by a bump, blow, or jolt to the head or by a hit to the body that causes the head and brain to move rapidly back and forth. **No Loss of Consciousness** is needed to diagnose concussion.
- This motion of the brain causes changes internal to the nerve cell, but not typically a structural change that can be seen on CT or MRI of the brain.

Evolution of Concussion Knowledge



Brain Motion...

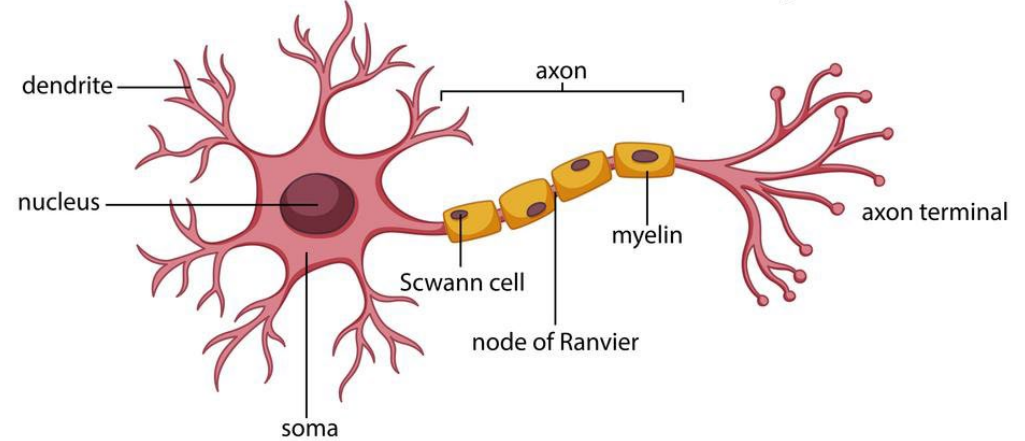


NERVE CELLS ARE
LONG AND PRONE TO
ROTATION AND
SHEARING INJURY

CEREBRAL NEURONS ARE <1MM TO 100 MM
= 4 INCHES IN LENGTH

- BRAIN CELL

Neuron Anatomy



PATHOPHYSIOLOGY

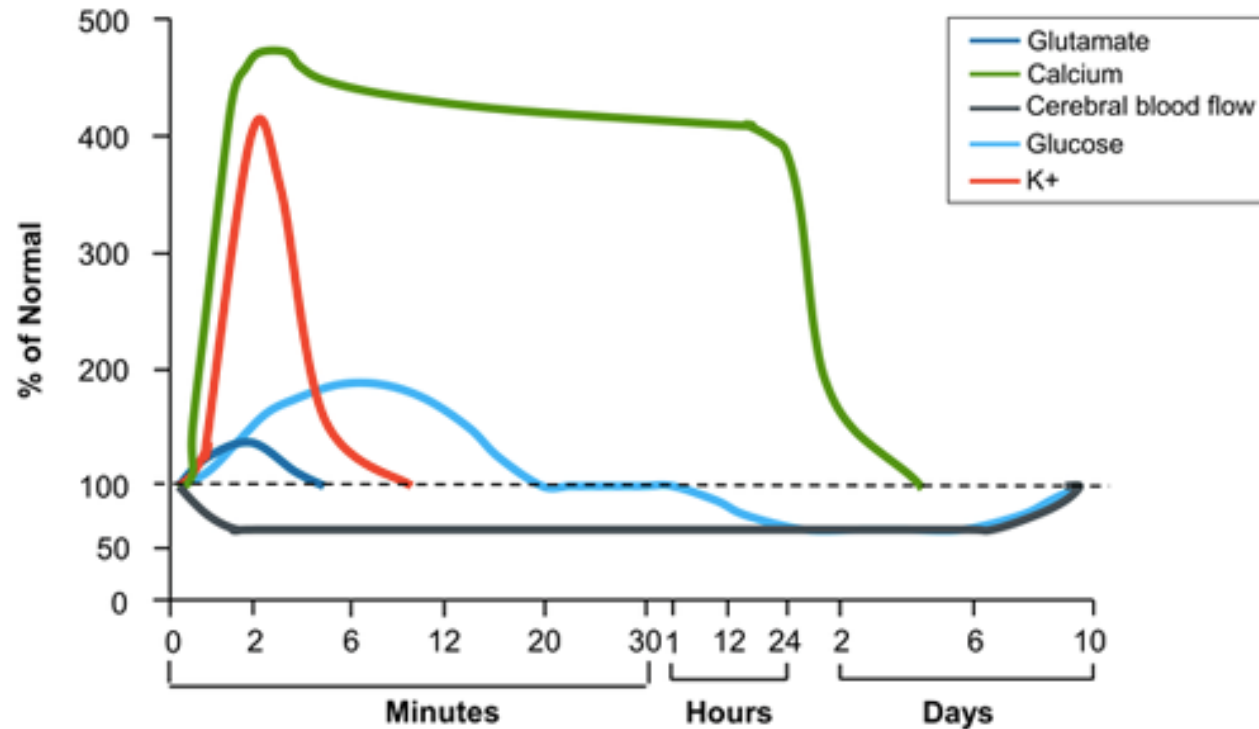
INCLUDES *METABOLIC, PHYSIOLOGICAL, AND MICROSTRUCTURAL* INJURY

- i. ABNORMAL ION FLUXES (K⁺ AND CA⁺⁺)*
- ii. EXCITATORY NEUROTRANSMITTER RELEASE (GLUTAMATE)*
- iii. INCREASED GLUCOSE METABOLISM (ENERGY CRISIS)*
- iv. LACTIC ACID ACCUMULATION*
- v. INFLAMMATION*
- vi. DECREASED CEREBRAL BLOOD FLOW*

GIZA & HOVDA. J OF ATHL TRAIN, 2001; 36:228.

PATHOPHYSIOLOGY

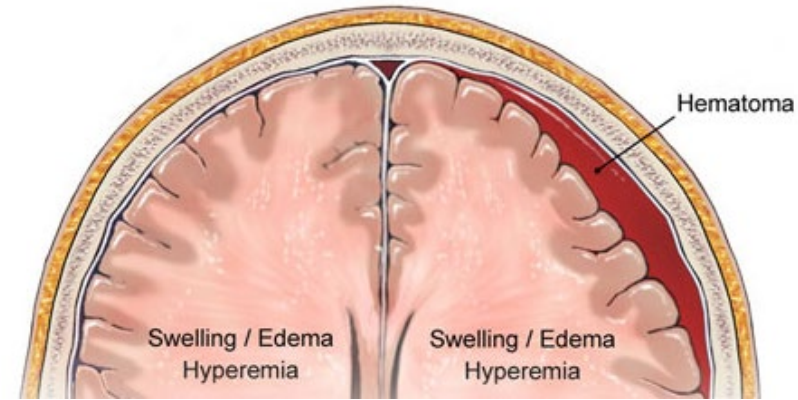
Neurometabolic Cascade Following Cerebral Concussion/mTBI



WHY DO WE CARE ABOUT CONCUSSIONS?

- SECOND IMPACT SYNDROME
 - VERY RARE, BUT ALMOST ALWAYS CATASTROPHIC
 - OCCURS WHEN THE BRAIN SWELLS RAPIDLY AFTER A PERSON SUFFERS A 2ND CONCUSSION BEFORE SYMPTOMS FROM AN EARLIER ONE HAVE RESOLVED, USUALLY IN FIRST 24 HOURS

Second Impact Syndrome: **Diffuse swelling with hematoma.**

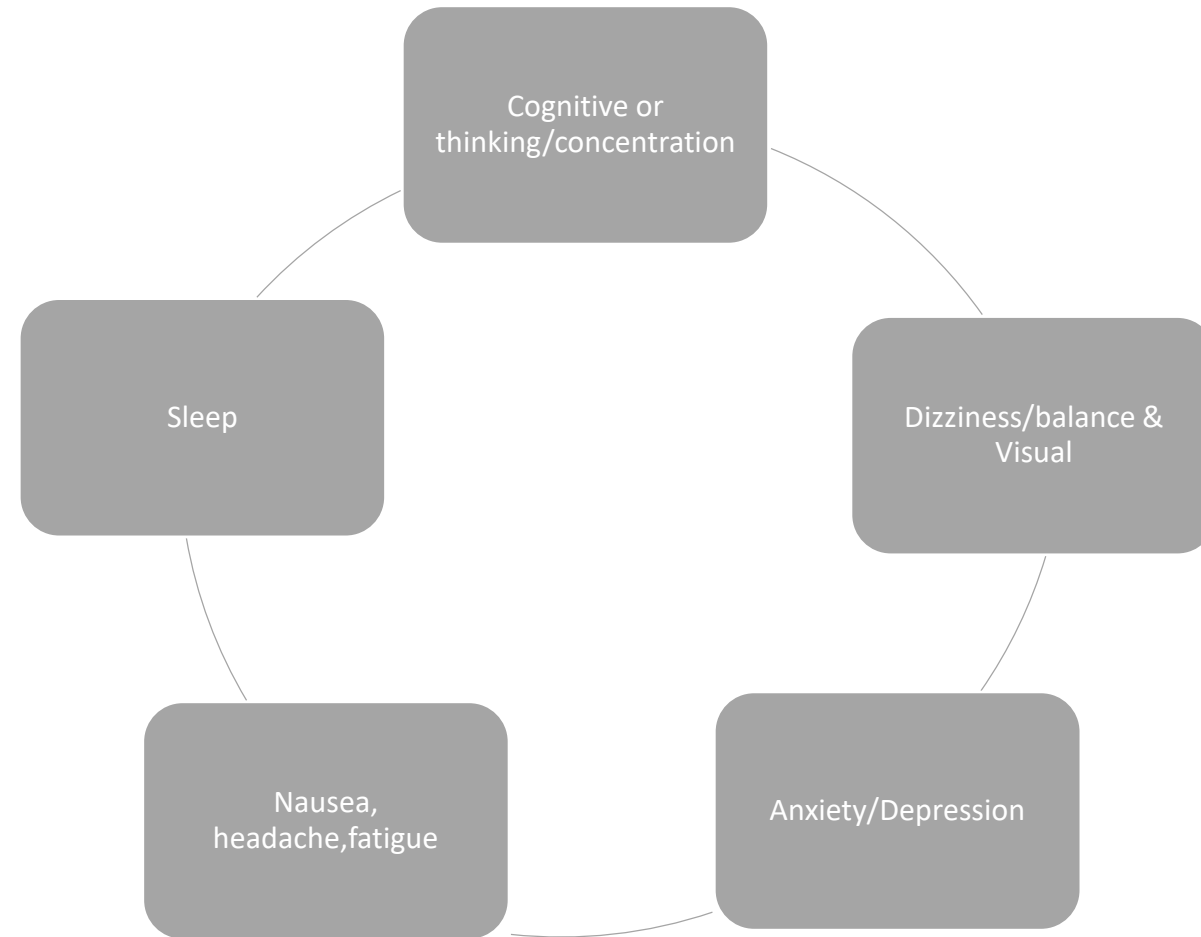


Protective gear – does it prevent concussion?

- Helmets – protects from skull fractures and major bleeding, but not concussion
- Q collars , cowboy collars – do not prevent concussion
- Mouth guards – do not prevent concussion
- Rule changes – has reduced severe brain injuries and number of



CONCUSSION SYMPTOMS



EXERCISE THERAPY

IT IS CLEAR THAT SOME REST, BOTH PHYSICAL AND COGNITIVE, IS BENEFICIAL TO ALLOW THE BRAIN TO RECOVER FROM THE ACUTE METABOLIC CRISIS OF CONCUSSION. CONVERSELY, TOO MUCH REST AFTER CONCUSSION MAY HAVE ADVERSE PHYSIOLOGICAL AND PSYCHOLOGICAL CONSEQUENCES AND CONTRIBUTE TO PROLONGED SYMPTOMS.

Leddy, J. J., Baker, J. G., & Willer, B. (2016). Active Rehabilitation of Concussion and Post-concussion Syndrome. *Physical Medicine and Rehabilitation Clinics of North America*, 27(2), 437-454. doi:10.1016/j.pmr.2015.12.003

Regular physical activity enhances CBF control

VISION, VESTIBULOCULAR SYMPTOMS

- REFER TO NEURO-OPTOMETRIST
- VISUAL ACUITY IS NOT USUALLY EFFECTED
- CONVERGENCE INSUFFICIENCY
- GAZE STABILITY – SACCADIC EYE MOVEMENT DISORDER
- VISION THERAPY AT OPTOMETRY OFFICE OR WITH OCCUPATIONAL THERAPY

SYMPTOM MANAGEMENT

HEADACHES:

- IBUPROFEN 400MG TID (SE: REBOUND HA)
- GABAPENTIN 100 – 300MG TID
- AMITRIPTYLINE/NORTRIPTYLINE – LOW DOSE
- VITAMIN B2 (RIBOFLAVIN) 400MG DAILY
- MAGNESIUM 600MG DAILY
- ALPHA LIPOIC ACID
- COENZYME Q10
- ACUPUNCTURE
- FOR ADULTS, CONSIDER BOTOX INJECTIONS

DIZZINESS

- PHYSICAL THERAPY, OCCUPATIONAL THERAPY, FUNCTIONAL MEDICINE - NEUROCHIROPRACTORS, VISION THERAPY

SYMPTOM MANAGEMENT

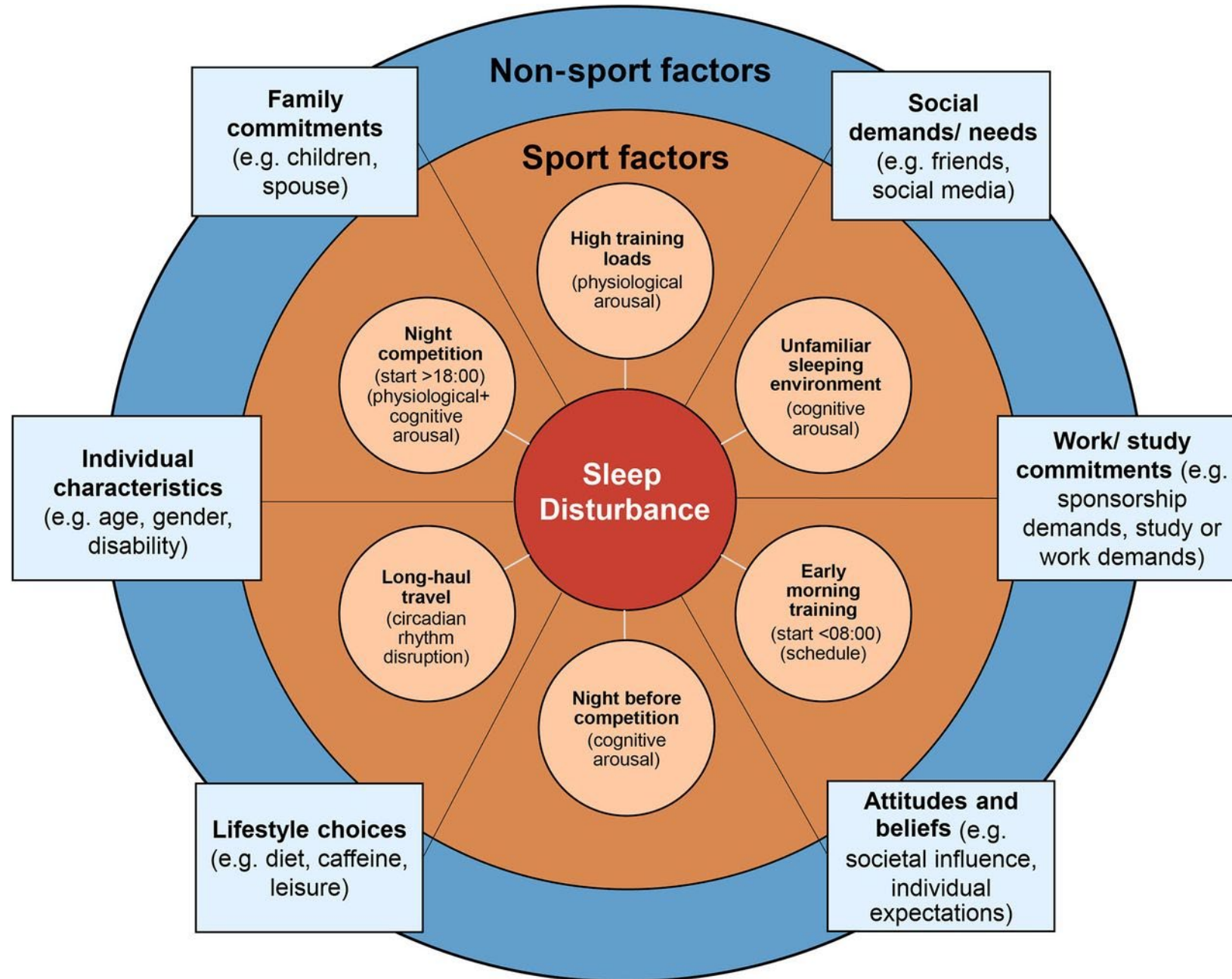
NAUSEA

- ACTIVITY MODIFICATION
- ONDANSETRON (SE: HA, DROWSINESS, DIZZINESS)
- TREAT DIZZINESS

SLEEP DISTURBANCE

- SLEEP HYGIENE
- MELATONIN 3-5MG
- ESSENTIAL OILS (LAVENDER)





PSYCHOLOGICAL INTERVENTION

RISK FOR CLINICAL DEPRESSION:

- 0 CONCUSSIONS: 6.4%
- 1-2 CONCUSSIONS: 9.8%
- 3+ CONCUSSIONS: 21.2%

REFER FOR COUNSELING AND/OR
TREAT WITH SSRI



Guskiewicz, K., et al. *Medicine & Science in Sport & Exercise*, 2007;39(6), 903-909.

CHRONIC TRAUMATIC ENCEPHALOPATHY (CTE)

Phillip Adams suffered several concussions during his NFL career. Photograph: Jeff Kowalsky/EPA

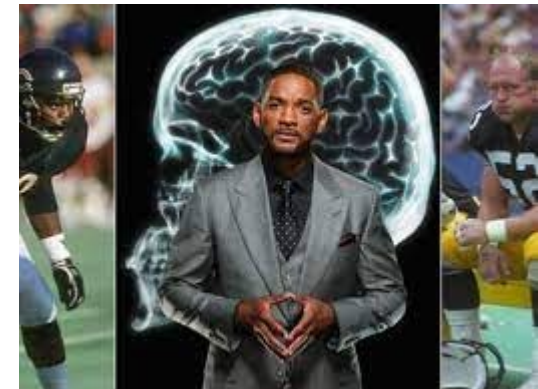
Former NFL player accused of killing six people was suffering from severe CTE

- **Phillip Adams apparently shot six dead before taking own life**
- **CTE linked to concussions and can cause aggression and paranoia**



LONG TERM EFFECTS OF CONCUSSION

- TYPICALLY FULL RECOVERY
- MULTIPLE CONCUSSIONS CAN BE ASSOCIATED WITH LONG TERM HEADACHE SYNDROMES, MILD NEURO-COGNITIVE DEFICITS, DEPRESSION/ANXIETY
- CTE OUTCOMES, STILL TOO EARLY TO TELL. MORE EVIDENCE OF THE TOTAL NUMBER OF SUB-CONCUSSIVE BLOWS MAY BE A SIGNIFICANT FACTOR ALONG WITH GENETICS, ETC.
- A SINGLE CONCUSSION HAS NOT BEEN ASSOCIATED WITH CTE
- MEZ, ET AL. ANN NEUROL. 2020 JAN; 87(1): 116–131. PUBLISHED ONLINE 2019 NOV 23. DOI: 10.1002/ANA.25611



MRI FINDINGS MAY BE HELPFUL SOON – NOT YET READY CLINICALLY

- "SPECIFICALLY, THOSE WITH CTE HAD SHRINKAGE IN THE FRONTAL AND TEMPORAL LOBES OF THE BRAIN, THE REGIONS MOST IMPACTED BY CTE," MEZ SAID IN A UNIVERSITY NEWS RELEASE."
- ACCORDING TO STUDY LEAD AUTHOR MICHAEL ALOSCO, "MRI IS COMMONLY USED TO DIAGNOSE PROGRESSIVE BRAIN DISEASES THAT ARE SIMILAR TO CTE SUCH AS ALZHEIMER'S DISEASE. FINDINGS FROM THIS STUDY SHOW US WHAT WE CAN EXPECT TO SEE ON MRI IN CTE. THIS IS VERY EXCITING BECAUSE IT BRINGS US THAT MUCH CLOSER TO DETECTING CTE IN LIVING PEOPLE." ALOSCO IS ASSOCIATE PROFESSOR OF NEUROLOGY AT THE BOSTON UNIVERSITY SCHOOL OF MEDICINE AND CO-DIRECTOR OF THE ALZHEIMER'S DISEASE CENTER CLINICAL CORE.
- "THERE IS MORE TO DO AS WE STILL NEED TO UNDERSTAND WHETHER THE PATTERNS WE SAW ON MRI ARE SPECIFIC TO CTE, THAT IS, DO THEY DIFFERENTIATE CTE FROM ALZHEIMER'S DISEASE AND OTHER CAUSES OF DEMENTIA."
- ALOSCO ET AL. ALZHEIMER'S RESEARCH THERAPY. 2021; 13:193

MULTIPLE CONCUSSIONS

- CHRONIC MIGRAINE OR CHRONIC DAILY HEADACHE MANAGEMENT
- ADDRESS ANXIETY AND DEPRESSION
- DISORGANIZATION AND FRONTAL LOBE CHANGES WITH DECREASED EXECUTIVE FUNCTION

CONCUSSION/TBI MANAGEMENT TEAM

The Student/Family,
Worker, Adult

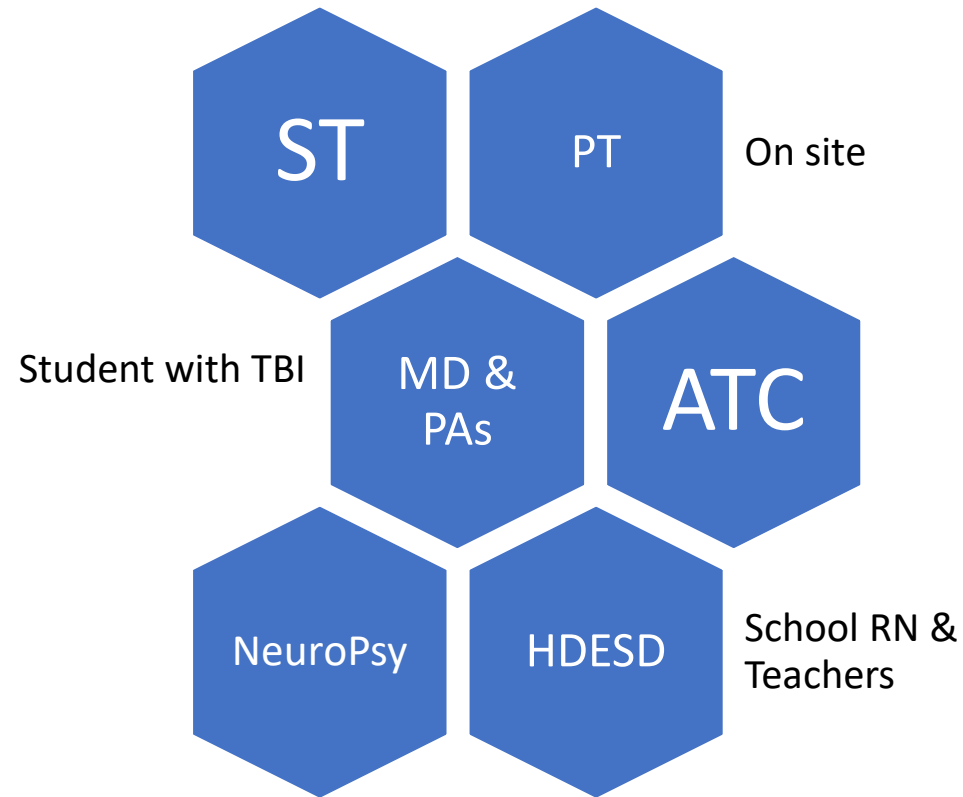
ATC/School
RN/Counselors

ER, Urgent Care, Trauma
and Neurosurgery

PCPs/Specialty
Care/NeuroPsy, PT, OT,
SLP, Alternative

Teachers/Coaches/School
Coaches HDESD

MULTIDISCIPLINARY CONCUSSION CLINIC AT THE CENTER – PERSISTENT, DIFFICULT SYMPTOMS



CASE STUDY – STUDENT



- 14 YEAR OLD FEMALE FRESHMAN 3RD CONCUSSION FROM RUGBY
- EVALUATED BY SCHOOL RN, SEEN BY NEUROPSYCHOLOGY AT PEDIATRICIANS OFFICE
- REFERRED TO CONCUSSION CLINIC FOR PERSISTENT SYMPTOMS
- REFERRALS TO SLP, PT AND OPTOMETRY AND COUNSELLING
- MEDICATION TRIALS FOR PERSISTENT HEADACHES
- SCHOOL COACH TO HELP WITH CLASS CURRICULUM MODIFICATION
- NEUROPSYCHOLOGY EVALUATION

Central Oregon Return to learn study

- CDC funded University of Oregon study
- Comparison of our coordinated care program with Ohio who doesn't have this model

SCHOOLS Traumatic Brain Injury in Children

HELP CHILDREN RETURN TO SCHOOL AFTER A TBI

Because children's daily lives are centered on school, returning to class after a Traumatic Brain Injury (TBI) is a critical transition.

Learning, behavioral, and social problems can emerge over time as school demands increase. Schools play an important role in managing a child's TBI. The more educators know about TBI, the better they will be able to support students with



WHAT IS A TBI?

A Traumatic Brain Injury disrupts the normal functioning of the brain. A bump, a blow, or a jolt to the head can cause a TBI. With the brain still developing, a child is especially at risk for long-term effects from a TBI. These injuries range from mild to severe. Mild TBI, referred to as mTBI or concussion, is most common.

| CDC's Report to Congress outlines current gaps

Educational Accommodations Checklist for Concussions

Patient name: _____ Date: _____
I, _____, give permission for my physician to share the following information with my child’s school and for communication to occur between the school and my physician for changes to this plan. Parent signature: _____
Physician Name and Contact information: _____ Physician Signature: _____
The patient will be reevaluated for revision of these recommendations in _____ weeks. Date: _____

Computerized Neurocognitive Testing

☐ Base Line ☐ Post-Injury Testing ☐ Passport ID #:

Area	Requested Accommodations	Comments/ Clarifications
Attendance	<input type="checkbox"/> No School <input type="checkbox"/> Partial School day as tolerated by student <input type="checkbox"/> Full school day as tolerated by student <input type="checkbox"/> Water bottle in class / snack every 3-4 hours as needed	
Breaks	<input type="checkbox"/> If symptoms appear/worsen, allow student to go to quiet area or nurse’s office; if no improvement after 30 min allow dismissal to home <input type="checkbox"/> Mandatory Breaks <input type="checkbox"/> Allow breaks during the day as needed by student or school personnel	
Visual Stimulus	<input type="checkbox"/> Enlarged print (18 font) copies of classwork material/assignments <input type="checkbox"/> Pre-printed notes (18 font) or note taker for class material <input type="checkbox"/> Limited computer, TV screen, bright screen use <input type="checkbox"/> Reduce brightness of screens/monitors <input type="checkbox"/> Allow handwritten assignments (as opposed to typed) <input type="checkbox"/> Allow student to wear sunglasses/hat in school, seat student away from windows and bright lights <input type="checkbox"/> Change classroom seating to front of room as necessary	
Auditory Stimulus	<input type="checkbox"/> Avoid loud classroom activities and/or classes <input type="checkbox"/> Lunch in a quiet place with a friend <input type="checkbox"/> Allow student to wear earplugs as needed <input type="checkbox"/> Allow class transitions before bell	
School Work	<input type="checkbox"/> Simplify tasks <input type="checkbox"/> Short breaks between tasks <input type="checkbox"/> Reduce overall amount of in-class work or homework <input type="checkbox"/> No homework <input type="checkbox"/> Extra tutoring/assistance requested <input type="checkbox"/> May begin make-up of essential work	
Testing	<input type="checkbox"/> No testing <input type="checkbox"/> Additional time/untimed testing <input type="checkbox"/> No more than one test a day <input type="checkbox"/> No standardized testing	
Educational Plan	<input type="checkbox"/> Student is in need of an IEP and/or 504 Plan (for prolonged symptoms last >3 months, if interfering with academic performance)	
Physical Activity	<input type="checkbox"/> No physical exertion/athletics/gym/recess <input type="checkbox"/> Walking in PE/recess only <input type="checkbox"/> May begin return to play	
Extracurricular Activities	<input type="checkbox"/> Ok to participate in school dances <input type="checkbox"/> Ok to attend school/sporting events (Please specify) <input type="checkbox"/> Ok to attend field trips <input type="checkbox"/> Other (Please specify)	

BASELINE STUDIES



IMPACT TESTING CONTROVERSIES

- SANDBAGGING – DELIBERATE POOR PERFORMANCE ON BASELINE
- DIFFICULTY IN PROTOCOL REVIEW OF VALID BASELINES (IMPULSE CONTROL COMPOSITE SCORE, <1% SCORE)
- LEARNING EFFECT WITH REPEATED TESTS
- EFFECTS ON TEST PERFORMANCE IF <7 HOURS OF SLEEP, ENVIRONMENTAL DISTRACTIONS (TESTING >20 AT A TIME), CAFFEINE CONSUMPTION, ANXIETY/DISTRESS ETC.
- SENSITIVITY 79-95%, SPECIFICITY 89-97% (4 PEER REVIEWED PAPERS)
- VALIDITY RANGED BETWEEN .2 -.88 COMPARED TO TRADITIONAL NP TEST
- RELIABILITY – TEST/RETEST WAS POOR FOR SHORTER INTERVALS, BETTER FOR LONGER

RESCH, ET AL. NEUROPSYCHOL REV (2013) 23:335-349

MCCLURE, ET AL. TESTING IN SPORTS-RELATED CONCUSSION. AM J SPORTS MED 2014;42:472-8

**All-in-One Mobile Solution
for Baseline Testing**



Sway Offers:

- ✓ Objective Balance Testing
- ✓ Full Battery of Cognitive Tests
- ✓ Five On-Field Assessments
- ✓ In-depth Clinical Report

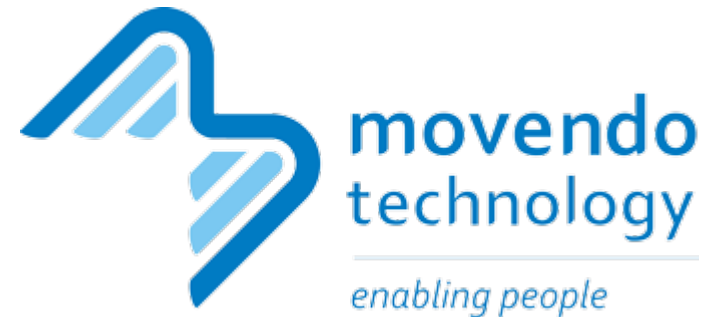
 SwayMedical.com [Download version 5.8.1 now!](#)





BASELINES AVAILABLE IN CENTRAL OREGON

- COMPUTER BASED TESTING –
IMPACT – AGES 12- 80
PEDIATRIC IMPACT - AGES 5-11
ADVANCED BALANCE TESTING
WITH HUNOVA
SWAY
KING – DEVICK VISUAL PROCESSING TEST



EVALUATE COMMUNITY OUTCOMES IN THE MANAGEMENT OF MTBI IN ADULTS AND CHILDREN.

- CONCUSSION DATA FOR OUR SCHOOLS
- RECURRENT CONCUSSION RATES
- RETURN TO LEARN AND PLAY DATA
- HEADACHE MANAGEMENT IN THE CENTER CONCUSSION CLINIC

RECURRENT CONCUSSIONS IN HIGH SCHOOLS

- OHIO UNIVERSITY STUDY OVER 2005-2016, 100 HS ACROSS THE COUNTRY
- COMPARED RECURRENT CONCUSSION RATES BEFORE AND AFTER TBI LAWS
- 2009 FIRST TBI LAW PASSED IN WA QUICKLY FOLLOWED BY OR. 2014 ALL 50 STATES
- OVER THE ENTIRE PERIOD, RECURRENT RATES WERE 11.3%
- HIGHEST RECURRENT RATE 14.2% IN 2005 AND LOWEST 2016 AT 7.3%
- RECURRENT CONCUSSIONS SHOWED SIGNIFICANT DECLINE FROM 2.6 YRS FROM LAW
- YANG, E TAL. 2017 AM J PUBLIC HEALTH

SPORTSWARE DATA 2011-2013

- 2 ACADEMIC YEARS
- 5 HIGH SCHOOLS WITH ATC RECORDED CONCUSSIONS
- 282 TOTAL CONCUSSIONS IN 2 YEARS
- 17 RECURRENT CONCUSSIONS IN 14 ATHLETES = $17/282 = 6\%$ RECURRENT CONCUSSION RATE
- TIME BETWEEN CONCUSSIONS, MEAN = 9 MONTHS, RANGE .5-24 MONTHS
- TIME BETWEEN DATE OF INJURY TO RETURN TO PLAY WAS 4 -111 DAYS (SMALL SUBSET, MT. VIEW). MEAN = 25.7 DAYS



2013-2016 ACADEMIC YEARS



- TOTAL OF 275 CONCUSSIONS TREATED BY OUR ATC'S IN BEND, SISTERS, LAPINE, CROOK COUNTY = 6 HIGH SCHOOLS
- 19 RECURRENT CONCUSSIONS
- RECURRENCE RATE 6.5%, SIMILAR TO 6% RATE FROM YEARS 2011-2013
- **REPORTED RECURRENT RATES IN HIGH SCHOOL ATHLETES IN OHIO WERE 13.5-15%**
- **CASTILE, L, ET AL. BR J SPORTS MED 2012; 46:603**

2017-2019 ACADEMIC YEARS

- TOTAL OF 163 CONCUSSIONS IN 2017-2018 (NOW COVERING 8 HIGH SCHOOLS)
- TOTAL OF 199 CONCUSSIONS IN 2018-2019
- FOR 2 YEARS TOTAL 362 CONCUSSIONS, 24 RECURRENT CONCUSSIONS IN THIS TIME FRAME – 6.6% RECURRENT CONCUSSION RATE.



THE CENTER CONCUSSION CLINIC

- ONE YEAR REVIEW, PEDIATRIC POPULATION ONLY
- N=97, 76 WITH HEADACHES – 78%
- HEADACHE DAYS TO RESOLUTION RANGED FROM 1-670, MEAN WITHOUT 670 DAYS OUTLIER = 9 DAYS
- RETURN TO LEARN (CLASSROOM WITHOUT RESTRICTIONS) MEAN = 10 DAYS
- RETURN TO PLAY WITHOUT RESTRICTIONS MEAN = 28 DAYS



PROGRAM GROWTH

- EXPANSION FROM 5 SCHOOLS TO 8 SCHOOLS (3 RURAL COUNTIES)
- IMPROVED RELATIONSHIP WITH COMPETING ORTHO GROUP WHO COVERS THE OTHER 2 CENTRAL OREGON HIGH SCHOOLS
- COVERING MIDDLE SCHOOL FOOTBALL
- IMPROVED COORDINATION WITH SCHOOLS WITH SCHOOL FUNDED SCHOOL COACHES (ORIGINALLY DONATED TIME FROM HDESD)



SUMMARY

- CONCUSSIONS CAN OCCUR WITHOUT LOSS OF CONSCIOUSNESS
- CONCUSSION PROTOCOL IS HELPFUL IN RETURNING CHILDREN TO PLAY SAFELY
- BASELINE TESTING AND SPECIALIZED TESTING IS AVAILABLE IN CENTRAL OREGON
- CONCUSSION CLINICS ARE AVAILABLE TO HELP MANAGE PERSISTENT SYMPTOMS
- COORDINATION OF CARE HELPS CHILDREN GET BACK TO THE CLASSROOM AND DECREASES SYMPTOMS
- A SINGLE CONCUSSION IS NOT ASSOCIATED WITH CTE

Return to learn

- **What is the Return to School Project?** The Return to School project is a research study to evaluate the effectiveness of a return to school model of services and supports for students with concussion or brain injury. The project is funded by the Centers for Disease Control and Prevention. The principal investigators are Ann Glang, PhD and Deanne Unruh, PhD from the University of Oregon.
<https://returntoschoolproject.org/>
- **What will participants be asked to do?**
- Parents and students will be asked to answer online survey questions at set times until the student is no longer experiencing symptoms related to their concussion/brain injury. Parents and students will each receive \$50 for their participation.
- **Who do families contact to ask questions or enroll in the study?**
- Families should email Jody Slocumb at: slocumbj@cbirt.org
- or call: 541-346-0567