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But, what if we're wrong... about concussion?

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## Introduction

- . Prelude
- . Case(s)
- . Trends & Overview of Concussion
- . Current standard examination process(es)
- . Current management process
- . SCAT 5
- . Proposed changes of exam and ICP management
- . Conclusion

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## Introduction

### Objectives

Establish or validate a stronger appreciation for cervical spine disorders when patients present with “concussion-like” symptoms.

Appreciate a **concept** of Best Practice for such clinical presentation.

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## Ipsitive Quiz

- . T or F – There is an EIP definition of Concussion.
- . T or F – There is a Gold Standard Assessment for Concussion.
- . T or F – There is a Best Practice for Concussion management.
- . T or F - Ssx's of a concussion are unique.
- . T or F – If someone loses consciousness, they clearly have suffered a severe concussion.

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Northwestern Health Sciences University **Changes in health 'science'**

- Calcium and Vit D are necessary for bone health
- J. G. Zhao, 2017 JAMA Dec.;318(24) **Wrong!**
- We should drink less coffee...
- H. Chung, 2017 Korean J Fam Med May;38(3) **Wrong!**
- Frequent meals are better than fewer larger meals...
- M. Mattson, 2014 (Nat'l Institute on Aging) **Wrong!**
- Eggs and other high cholesterol foods will raise your cholesterol...
- Metabolism. 2013 Mar;62(3):400-10. **Wrong!**
- Stretching before exercise prevents injury
- Rev Med Suisse. 2005 Jul 27;1(28):1830-4. **Wrong!**
- It's impossible for a human to run a mile under 4 minutes!
- The IAAF - Hicham El Guerrouj, 3:43.13 **Wrong!**
- Football is a risk for concussion... **Wrong!**

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Northwestern Health Sciences University **Why is this a THING?**

**News Flash!**

**Chiropractor cited in brain injury lawsuit**  
 Story Published Jan 22, 2016 KOMONews.com Seattle, Washington

A chiropractor is being sued along with a school district for brain injuries suffered by a teenage athlete who was allowed to return to playing football after multiple concussions. "The lawsuit alleges that the DC was not qualified to medically clear the athlete to return to play after multiple concussions, including one in which he had to be taken off the field on a stretcher. The suit says the DC lacked the necessary specialized training and knowledge to make such a decision. It states that the district "either knew or should have known this fact," about the chiropractor. Even if the DC had been qualified, according to the suit, the district failed to meet the accepted standard protocol for making return-to-play decisions that included constant testing to make sure symptoms did not return."  
<http://www.komonews.com/news/local/82474567.html>

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Northwestern Health Sciences University **My view**

- "**Concussion**" is the "**Sciatica**" of sport.
- We do not have an evidence-based definition for concussion,**
- There is no gold-standard diagnosis,**
- There is no best-practice treatment.**
- "Like sciatica, concussion is diagnosed too frequently and other treatable conditions are missed resulting in chronicity involving ongoing pain, depression, etc. Media has greatly outpaced the science of concussion creating too much fear in society. We need a higher level of competency in our clinicians to investigate deeper when an athlete presents with "concussion – like" symptoms. A good start would be to include a sport chiropractor as one of your opinions."

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Northwestern Health Sciences University **Case**

- Minnesota Vixen Football Player
- MOI = tackle
- Player states she loss consciousness briefly
- Headache and left-sided neck pain



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Northwestern Health Sciences University Case

- Player was triaged on the sideline.
- Presented to me three days later with no change in her complaints
- Positive concussion testing and cervical spine findings.




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**History & Exam**


- Observation: signs of light sensitivity
- Palpation: Lt Levator, C2 Lt, C4 Rt., T3 Lt.
- ROM: decreased to left by approx. 15 degrees
- Ortho: Odonahues (minimally)
- Neurovasc: Neg.
- Special:
  - Concussion tests
  - Mod. BESS, recall...



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Northwestern Health Sciences University Case

- Educated the patient on her **diagnosis**, potential complications, treatment options.
- Adjusted her thoracic and cervical spine.
- Educated on a levator scapulae stretch
- Applied Theraband Xact Stretch tape.



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Northwestern Health Sciences University Case

- **Second visit** (2 days later) she reported an 80% improvement. She was cleared to add jogging and light conditioning.
- **Third visit** (3 days later) she reported 100% improvement. Cleared for sprinting, agility work and walk-thrus.
- **Fourth visit** (2 days later). No complications to activity. Cleared to start hitting. If no complications, she was cleared to do full practice.



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Northwestern Health Sciences University **Definition**

**Concussion;** 2012 Zurich Consensus Statement

“...a complex pathophysiologic process **affecting the brain**, induced by biomechanical forces..., which may be caused by a blow to the head, face, neck or elsewhere on the body with an **impulsive force** transmitted to the head.”

**Whiplash;** 2010 Ugeskr Laeger Jun 14;172(24):181-4

“...a trauma caused by an **acceleration-deceleration force** transferring its energy to the cervical spine.”

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Northwestern Health Sciences University **Definition**

“14 years ago we understood that an **acceleration-deceleration force** could result in **Concussion-like symptoms.**”

J Athl Train. 2001;36:253-256


*Acceleration-deceleration sport-related concussion: the Gravity of it all.*

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Northwestern Health Sciences University **Visual Understanding**

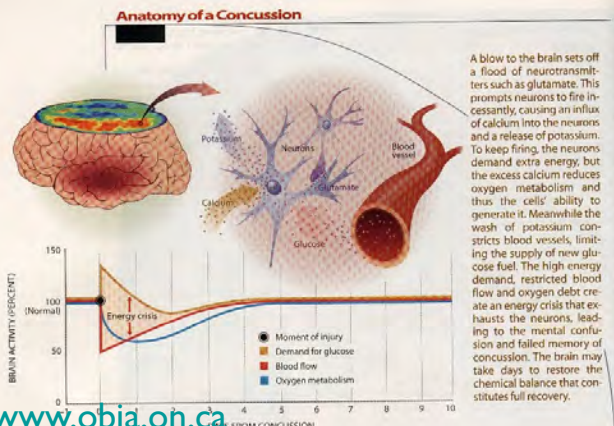
**Acceleration/Deceleration/Impact**

Tales of a Human Crash Test



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Northwestern Health Sciences University **Concussion Physiology**



**Anatomy of a Concussion**

A blow to the brain sets off a flood of neurotransmitters such as glutamate. This prompts neurons to fire incessantly, causing an influx of calcium into the neurons and a release of potassium. To keep firing, the neurons demand extra energy, but the excess calcium reduces oxygen metabolism and thus the cell's ability to generate it. Meanwhile the wash of potassium constricts blood vessels, limiting the supply of new glucose fuel. The high energy demand, restricted blood flow and oxygen debt create an energy crisis that exhausts the neurons, leading to the mental confusion and faded memory of concussion. The brain may take days to restore the chemical balance that constitutes full recovery.

www.obia.on.ca

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**Concussion – Diffuse Trauma**

The screenshot shows a browser window with a YouTube video. The video title is '(2) Egg Diffuse Trauma - You...'. The video content consists of three panels: 1) A close-up of a spatula lifting scrambled eggs in a pan. 2) A person in a dark jacket falling face-first onto a light-colored wooden floor. 3) A close-up of a single fried egg in a pan.

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**Concussion Trends**

**Name Calling...**

Yesterday → Today → Tomorrow

Bell Ringer   Grades   mTBI.....CTE   ????

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**Concussion Trends**

**Why is the 'Name' or diagnosis important?**

Carol Dematteo. *Pediatric*, February, 2010.

she discovered a difference in how children were managed based on their diagnosis after a head injury

"Concussion" = less time in the hospital and twice as likely to return to school sooner v. "Mild Traumatic Brain Injury"

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**Concussion Trends**

- I believe calling this SYNDROME a "mTBI" set-off a flood of emotions in health care and sport.
- **"Reflexive Diagnosing"** – Diagnosing without thorough clinical investigation.
- **The result** – Ryan MA, et al. Sports and Recreation-related Concussions in US Youth. *Pediatrics*. 2014;133(1):e20134633
- **1.1-1.9 million/year, <18y.o. American youth suffer a concussion.**
- **That's a 500% increase since 2010!**

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 May, 2017 Health News from NPR

## Concussion Trends

The LATEST trend... a **Spit Test** to diagnose a concussion.

**The claim is that an injured brain cell releases microRNA's (genetic material) that can be detected blood and saliva.**

In fact, one specific microRNA was able to detect which of the SSx's would remain longer (e.g. memory, problem solving, etc.).

It was 90% accurate v. survey concussion tests.

Research is ongoing at Penn State.

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## Concussion Trends

**Unfortunately...**

Change in participation for selected sports in the US

Sport	Change in participation (2008-2013)
Football (tackle)	-23.3%
Baseball	-14.5
Basketball	-9.3
Soccer (outdoor)	-8.9
Ice Hockey	27.9
Lacrosse	65.9
Rugby	81

Quartz | qz.com Data: Sports & Fitness Industry Association

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## Recent Trends in Law

### David Duerson Act

Illinois General Assembly  
 1 March, 2018

Bill Status HB4341 - Creates the "CTE Prevention Act"

"Provides that a child under the age of 12 may not participate in tackle football offered by an organized youth sports program."

<http://www.ilga.gov/legislation/fulltext.asp?DocName=&SessionId=91&GA=100&DocType=HB&DocNum=4341&GAID=14&LogID=109000&SpecSeq=&Session=>

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## Concussion Law

### Zackery Lystedt Law

2009 Federal Legislation: May 14, 2009

Any athlete <18 yo suspected of a concussion must receive a written medical authorization from a licensed physician before returning to play (RTP).

Some States allow DC's to be included with this law.

Minnesota DC's may write the RTP note.

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## Concussion Law

### Jake Snakenberg Act; Senate Bill – 040.

A progression on the Zackery Lystedt Law

As of January 1, 2012 CONCERNING THE REQUIREMENT THAT A COACH OF AN ORGANIZED YOUTH ATHLETIC ACTIVITY FOLLOW CONCUSSION GUIDELINES.

"HEALTH CARE PROVIDER" MEANS A DOCTOR OF MEDICINE, DOCTOR OF OSTEOPATHIC MEDICINE, LICENSED NURSE PRACTITIONER, LICENSED PHYSICIAN ASSISTANT, OR LICENSED DOCTOR OF PSYCHOLOGY WITH TRAINING IN NEUROPSYCHOLOGY OR CONCUSSION EVALUATION AND MANAGEMENT.

**SUBSECTION (4).** A DOCTOR OF CHIROPRACTIC WITH TRAINING AND SPECIALIZATION IN CONCUSSION EVALUATION AND MANAGEMENT MAY EVALUATE AND PROVIDE CLEARANCE TO RETURN TO PLAY FOR AN ATHLETE WHO IS PART OF THE UNITED STATES OLYMPIC TRAINING PROGRAM.

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## Specific Law; example

### 2011 Wisconsin Act 172

- 118.293 Concussion and Head Injury
- "Health care provider"
  - One who holds a credential (license or certificate) to provide health care
  - One who is trained and experienced in evaluating and managing pediatric concussions & head injuries.
  - One who is practicing within their scope of practice.
  - If an athlete is removed from activity due to head injury, a written notice from a Health care provider is necessary for RTA.

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## Another Case

### St. Agnes Football Game; 2016

- Center was asked to leave the field, by the ref., and "see the doctor".
- I asked the athlete why the Ref. thought he needed to see me.
  - Apparently the Center took a hit and the Ref. asked him what field he is playing on. The Center mispronounced the name of the Hamline Field (**Kbs Field**).
- I assessed the athlete who had no SSx's of a head injury. **Considering the lack of any SSX's, I was able to return the Center back to play within a few plays.**

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## mTBI in Minnesota

Dugan S., et al. This is Your Brain on Sports., Minnesota Medicine, September 2014.

Online Concussion reporting system

36 public schools

2013-2014 school year

730 sports-related concussions reported. Incidence was 1/100 athletes suffered a concussion.

Statewide it was then estimated that 2,974 sports-related concussion occurred.

Top reporting-sports for concussions;

Grid-iron Football	42%
Girls Soccer	9%
Boys Hockey	8%
Girls Hockey	7%

*Why is football so unique in this case!?*

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Northwestern Health Sciences University **mTBI in Minnesota**  
 Dugan S., et al. This is Your Brain on Sports., Minnesota Medicine, September 2014.

Girls typically experienced higher rates of concussions.

Girls experienced worse outcomes from concussions.

General note: observed was a higher incidence of concussions when:

- The sport involved higher speeds and
- The neck **strength** was lower.

*“Our concussions and neck injuries have decreased dramatically since we started those neck strengthening exercises!”  
 Coach Brandon Pelinka, Mn Vixen*

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Northwestern Health Sciences University Carney, N et al. Neurosurgery: September 2014-Volume75-Issue-pS1-S2

**Executive Summary of Concussion Guidelines Step 1: Systematic Review of Prevalent Indicators**

Indicators of concussion, observed in *alert* (*alert* = Glasgow Coma Scale Score, 13 to 15) individuals after a force to the head, are the following:

- \* Observed and documented disorientation or confusion
- \* Impaired balance within 1 day after injury,
- \* Slower reaction time within 2 days after injury, and
- \* Impaired verbal learning and memory within 2 days after injury.

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Northwestern Health Sciences University **Concussion/mTBI Assessment**

**Testing for;**

- Disorientation and confusion
- Impaired balance
- Reaction time
- Verbal learning and memory

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Northwestern Health Sciences University **Concussion/mTBI Assessment**

**Disorientation and confusion**

- Maddock’s Questions:
  - Where are we today?
  - Which period is it now?
  - Who scored last?
  - What team did you play last week?
  - Did you win the last game?


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Northwestern Health Sciences University **Concussion/mTBI Assessment**

**■ Impaired balance**

- BESS
  - Syst Rev. Bell, et al. May 2011
  - Reliability ranges from moderate to good.
  - High validity when measuring concussed pt's.
- Other balance tests



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Northwestern Health Sciences University **Concussion/mTBI Assessment**

**■ Reaction time**

- Dropping a ruler;
  - poor validity and reliability -MacDonald, et al. Clin J Sport Med 2015 Jan
  - sensitive and moderate reliability to distinguish concussed from non-concussed Eckner et al. Br J Sports Med 2014 Jan
  - favorable test with support of using this test. Eckner et al. J Athl Train 2011 Jul-Aug.
  - [Reaction time ruler test](#)
  - Moos, et.al. identified slowed reaction time in subjects that were under higher levels of stress. She also proposed a new Best Practice for performing this test. 2015 data collected. Not yet published.

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Northwestern Health Sciences University **Concussion/mTBI Assessment**

**■ Reaction time**

- Dropping a ruler;
- Moos, et.al. Suggested Best Practice...



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Northwestern Health Sciences University **Concussion/mTBI Assessment**

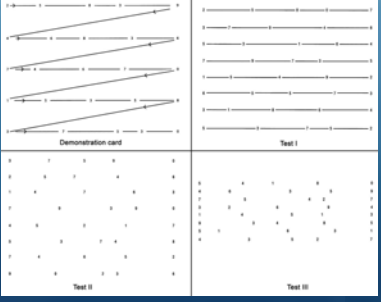
**■ Verbal learning and memory**

- 5-item recall.
  - E.g. Apple, Brick, Flag, Cat, Cheese
  - Ask again later in the exam
- Months of the year backwards

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Northwestern Health Sciences University **Concussion/mTBI Assessment**

- Other Assessments
  - ImPACT
  - King Devick



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Northwestern Health Sciences University **General Proposal**

After **triaging** your patient, consider placing more emphasis on cervical spine disorders when a patient presents with ‘concussion-like’ signs and symptoms.

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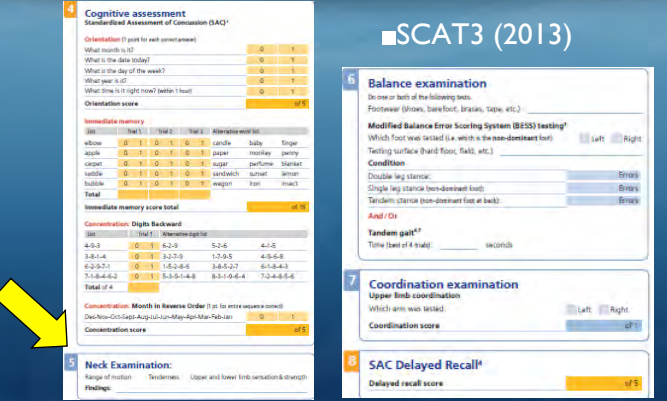
Northwestern Health Sciences University **Concussion/mTBI Assessment**

- SCAT3 (2013) has a small section assessing “Neck”;
  - ROM,
  - Tenderness
  - Upper and Lower limb sensation and strength



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Northwestern Health Sciences University **Concussion/mTBI Assessment**



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Northwestern Health Sciences University **Why should we include the C/s?**

<p>■ <b>Concussion SSx's</b></p> <ul style="list-style-type: none"> <li>■ Headache</li> <li>■ Neck pain</li> <li>■ Dizziness</li> <li>■ Emotional changes, sleeping problems</li> <li>■ Confusion, difficulty concentrating, visual disturbances</li> <li>■ Nausea</li> <li>■ Balance problems...</li> </ul>	<p>■ <b>Whiplash SSx's</b></p> <ul style="list-style-type: none"> <li>■ Headache</li> <li>■ Neck pain</li> <li>■ Dizziness</li> <li>■ Emotional changes, sleeping problems</li> <li>■ Visual disturbances</li> <li>■ Frustration</li> <li>■ Stress</li> <li>■ Fatigue...</li> </ul>
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Northwestern Health Sciences University **Why should we include the C/s?**

<p>■ <b>Post-Concussion SSx's</b></p> <ul style="list-style-type: none"> <li>■ Headache</li> <li>■ Dizziness</li> <li>■ Emotional changes, sleeping problems</li> <li>■ Confusion, difficulty concentrating, visual disturbances</li> <li>■ Frustration</li> <li>■ Fatigue</li> <li>■ Balance problems...</li> </ul>	<p>■ <b>Whiplash SSx's</b></p> <ul style="list-style-type: none"> <li>■ Headache</li> <li>■ Neck pain</li> <li>■ Dizziness</li> <li>■ Emotional changes, sleeping problems</li> <li>■ Visual disturbances</li> <li>■ Frustration</li> <li>■ Stress</li> <li>■ Fatigue...</li> </ul>
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Northwestern Health Sciences University **Last Case**

■ **Mn Vixen Athlete: Womens' pro football**

- Special Teams Player takes a hard hit.
- SSx's consistent with a Concussion/WAD
  - Positive SCAT3
  - Positive C/s findings
    - Palpation of the cervical spine recreated her headache, dizziness, etc.
- Tx. to the cervical spine resulted in elimination of her symptoms.
- Functional assessments did not recreate her SSx's.

**Returned to play!!**

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Northwestern Health Sciences University **NCAA Best Practice**

■ **Baseline Assessment; at minimum**

- Sx checklist
- Standard cognitive assessment (SCAT3)
- Balance assessment (BESS)
- Neuropsychological testing; computerized or pencil/paper (ImPACT)

Now we should add a cervical spine baseline evaluation

- Cervical functional performance
  - cranial flexion endurance,
  - lateral flexion maximum strength
- ROM and intersegmental motion
- Reaction time (field friendly)


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### Key Proposed Changes

- “Accurate and early detection of concomitant neck injury in concussed patients could allow for appropriate cervical spine care...”
- I.e., “The recognition of whiplash injury as part of the concussion syndrome would move treatment guidelines away from strict **rest-based protocols** that potentially may perpetuate into **disability**.”

■ Leddy, etal 2014.  
 ■ Schneider, etal. 2013.  
 ■ Silverberg, etal. 2013.



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### Key Proposed Changes

Gittleson, M. 2014 NCAA  
Collins CL, etal. 2014 J Primary Prevent

#### ■Prevention –

- “...we found high correlations between neck strength measurements and ratios of neck:head circumference to the incidence of concussions.”
- “For every **one pound** of neck strength gained, there was a decrease of concussion risk by **five percent**.”



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### Key Proposed Changes

Gittleson, M. 2014 NCAA  
Collins CL, etal. 2014 J Primary Prevent




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### Key Proposed Changes

Gittleson, M. 2014 NCAA  
Collins CL, etal. 2014 J Primary Prevent





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Northwestern Health Sciences University **Key Proposed Changes**

- **Prevention –**
  - Coaching techniques e.g.
    - Tackling skills
    - Strength coach – sport specific conditioning
  - Musculoskeletal health
    - Sports chiropractic, physical therapy, massage, general mobility
  - Equipment and other technology

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Northwestern Health Sciences University **Technology**



**KEEP YOUR HEAD IN THE GAME.** CHECKLIGHT sports / activity impact indicator

CHECKLIGHT™ sensors continuously measure impacts the athlete experiences and provides coaches, athletic trainers, parents and athletes with a simple visual display of impact severity.

FOR ALL SPORTS AND LEVELS OF PLAY WHERE CONTACT OCCURS

http://the-gadgeteer.com ©2015 Northwestern Health Sciences University

Northwestern Health Sciences University **Technology**

- **Stanford University News Service; Oct., 2012**



<http://news.stanford.edu/pr/2012/pr-football-concussion-study-102412.html>

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Northwestern Health Sciences University **Best Practices**

- **Assessments including baseline**
  - Mod. SCAT plus reaction time (ruler test)
  - ImPACT (and King Devick)
  - Cervical spine
    - Ortho, neuro, chiro (MoPal)
  - Functional performance
    - Cranial flexion endurance
    - Lateral flexion maximum strength
  - Imaging – Xray, CT (acute), MRI (non-acute)

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Northwestern Health Sciences University **Best Practices**

- **Conservative care management**
  - Wait and rest (traditional concussion mgmt)
  - SMT/CMT;
    - Johnson, CD., et al.. J Chiropr Med. 2013 Dec;12(4):216-29. Lit. Review.
    - CMT is "nascent" = just coming into existence and showing potential.
  - Soft tissue and cranial work
  - Sports Nutrition; inflammation management...
  - TCM; Inflammation management...
  - Referrals; neuropsych, visual, vestibular rehab, chronic pain specialists

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Northwestern Health Sciences University **Best Practices**

- **Prevention**
  - Education; Delaney, 2000; Goodman, 2002; McCrea, 2004
  - Quality coaching
  - Sports Physical
  - Spinal mobility and soft tissue integrity
  - Cervical spine strength
    - Cranial flexion endurance & max strength
  - Technology & Equipment?

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Northwestern Health Sciences University **SCAT 5**

- **Sport Concussion Assessment Tool**
- Prague/Zurich/Berlin Guidelines
  - From the 2<sup>nd</sup>, 3<sup>rd</sup>, 4<sup>th</sup>, 5<sup>th</sup> International Symposium on Concussion in Sport, (2004, 2008, 2012, 2016).
  - Prague recommends abandoning the grading scales.
    - Replacing with Simple v. Complex
  - Zurich recommended abandoning the Simple v. Complex categorization
- See your SCAT5 Exam document

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Northwestern Health Sciences University **SCAT 5**

**CERVICAL SPINE ASSESSMENT**

**CERVICAL SPINE ASSESSMENT**

Does the athlete report that their neck is pain free at rest?	Y	N
If there is <b>NO</b> neck pain at rest, does the athlete have a full range of <b>ACTIVE</b> pain free movement?	Y	N
Is the limb strength and sensation normal?	Y	N

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Northwestern Health Sciences University **Concussion**

- Zurich Concussion Management
  - The cornerstone of concussion management is **REST**.
  - REST **physically and cognitively**.
  - REST until symptoms resolve.
- Berlin**, however now states that rest should not last more than **24-48 hours!!**

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Northwestern Health Sciences University **Concussion**

Zurich/Berlin Guidelines:

- RTP stepwise process
- 1. Complete rest. Once asymptomatic then
- 2. light aerobic exercise such as walking or stationary cycling, **NO** resistance training
- 3. sport specific exercises, e.g. skating in hockey, running in soccer. Consider resistance training.
- 4. Consider resistance training. Non-contact training drills. Add cognitive load.
- 5. Full contact training after medical clearance.
- 6. Game play.

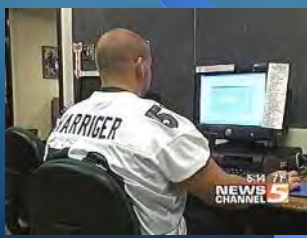
<http://images.jupiterimages.com>



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Northwestern Health Sciences University **Concussion**

- RTP advances in technology;
- ImPACT Concussion Management
  - Athlete Symptoms
  - Word Discrimination
  - Design Memory
  - X's and O's
  - Symbol Matching
  - Color Matching
  - Three Letters
  - Injury Description
  - Graph display of Data



Northwestern Health Human Performance Center Fédération Internationale de Chiropratique du Sport The International Federation of Sports Chiropractic

Northwestern Health Sciences University **Concussion**

- ImPACT
  - Available in 13 different languages including **JAPANESE!**
  - 2008 NATA Best in Show Contest for Software
  - [www.impacttest.com](http://www.impacttest.com)

Northwestern Health Human Performance Center Fédération Internationale de Chiropratique du Sport The International Federation of Sports Chiropractic

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ICD 9	ICD 10
<ul style="list-style-type: none"> <li>■ 850.9 Concussion, unspecified</li> <li>■ 850.5 Concussion w/ LOC                             <ul style="list-style-type: none"> <li>■ Further detailed codes for length of LOC</li> </ul> </li> <li>■ 847.0 Sprain or strain of the neck (whiplash)</li> <li>■ 739.1 Cervical segmental &amp; somatic dysfunction</li> <li>■ Others pending SSx's</li> </ul>	<ul style="list-style-type: none"> <li>■ S06.0X0A Concussion w/ out LOC</li> <li>■ S06.0X9A Concussion w/ LOC</li> <li>■ S13.8XXA Sprain or strain of the neck (whiplash)</li> <li>■ MM99.01 Cervical segmental &amp; somatic dysfunction</li> </ul>

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Northwestern Health Sciences University Educating the Community

- NWHSU has performed over 2400 **baseline** concussion tests in the community over the last three years.
- We offer a service to speak to community athletic organizations.
- We have a high quality (and well branded ☺) brochure.



<http://theconcussionblog.com/category/concussion-blog-original/parent-advocate/>

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- In your practice and community
  - Educate general information
  - Heads-up” programs via the CDC
    - 1-800-CDC-INFO
    - [CDC-INFO@cdc.gov](mailto:CDC-INFO@cdc.gov)
- Educating yourself?
  - NWHSU offers multiple opportunities

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Northwestern Health Sciences University Conclusion

- **Literature is trending towards a stronger involvement of the cervical spine when considering mTBI**
  - **Prevention** – ‘strengthening’ – Education - technology
  - **Assessment** – triage - cervical spine and key exam components (SCAT5), modified SCAT...
  - **Management** – inflammation, cervical spine and vestibular
- Integrative care should be considered

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Northwestern Health Sciences University The End

# Thank you!

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