Concussions: From Sideline to Office

MOA Spring Conference

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Disclosures

- None ☹

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Concussion

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Concussions

- ChatGPT:
  - A concussion is a type of brain injury that happens when your head or body experiences a sudden impact or jolt. This can cause the brain to move rapidly within the skull, which may lead to temporary changes in how your brain functions. It's like a bruise to the brain.

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On The Molecular Level

- Ion Imbalance: Neurons experience an influx of calcium and sodium, and an efflux of potassium, leading to disrupted cellular function
- Energy Crisis: The brain's demand for energy spikes, but reduced blood flow and mitochondrial dysfunction limit ATP production, causing an energy deficit
- Excitotoxicity: Excessive release of the neurotransmitter glutamate overstimulates neurons, leading to further damage
- Oxidative Stress: Free radicals are produced, damaging cellular structures and contributing to inflammation
- Axonal Injury: Axons are stretched or sheared, leading to structural damage and impaired communication between neurons

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Concussion Prevention Strategies

- Policy and rule changes
  - Hockey checking disallowed in children and adolescent ice hockey
    - Reduced concussions in games by 58%
  - American football changes to number of contact practices
    - 64% reduction in practice related concussions
  - Mouthguards in hockey
    - 28% reduction in concussions
- Neuromuscular training in warm-ups
  - Motor control, balance training, proprioception
- Optimal concussion treatment strategies

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Concussion

- Prevention
  - Guardian Caps
  - Q Collar
  - Soccer Headbands
  - SAFR

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Concussion Prevention

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Concussion Prevention

- Current evidence does not support the use of any wearable device as a reliable means to prevent concussions

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OpenEvidence - Does any wearable device prevent concussions

Concussion Evaluations

- SCAT-6/Child SCAT-6
  - Best used within 72hrs
    - Up to 1 week
- SCOAT-6/Child SCOAT-6
  - Outside 72hr
  - Serial evaluations
- Fluid biomarkers, advance neuroimaging, genetic testing
  - Emerging technologies but not suited for routine practice

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Sideline Coverage

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Guidance

- AMSSM and the Consensus Statement on Concussion in Sport
  - 6th edition

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Consensus Statement

- Summary of the evidence and practice recommendations based on science and expert panel consensus
  - SCAT-6/Child SCAT-6
    - Sport Concussion Assessment Tool-6
      - Sideline tool
  - SCOAT-6/Child SCAOT-6
    - Sport Concussion Office Assessment Tool-6

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Sideline Evaluation

Have a plan of how you will evaluate an athlete

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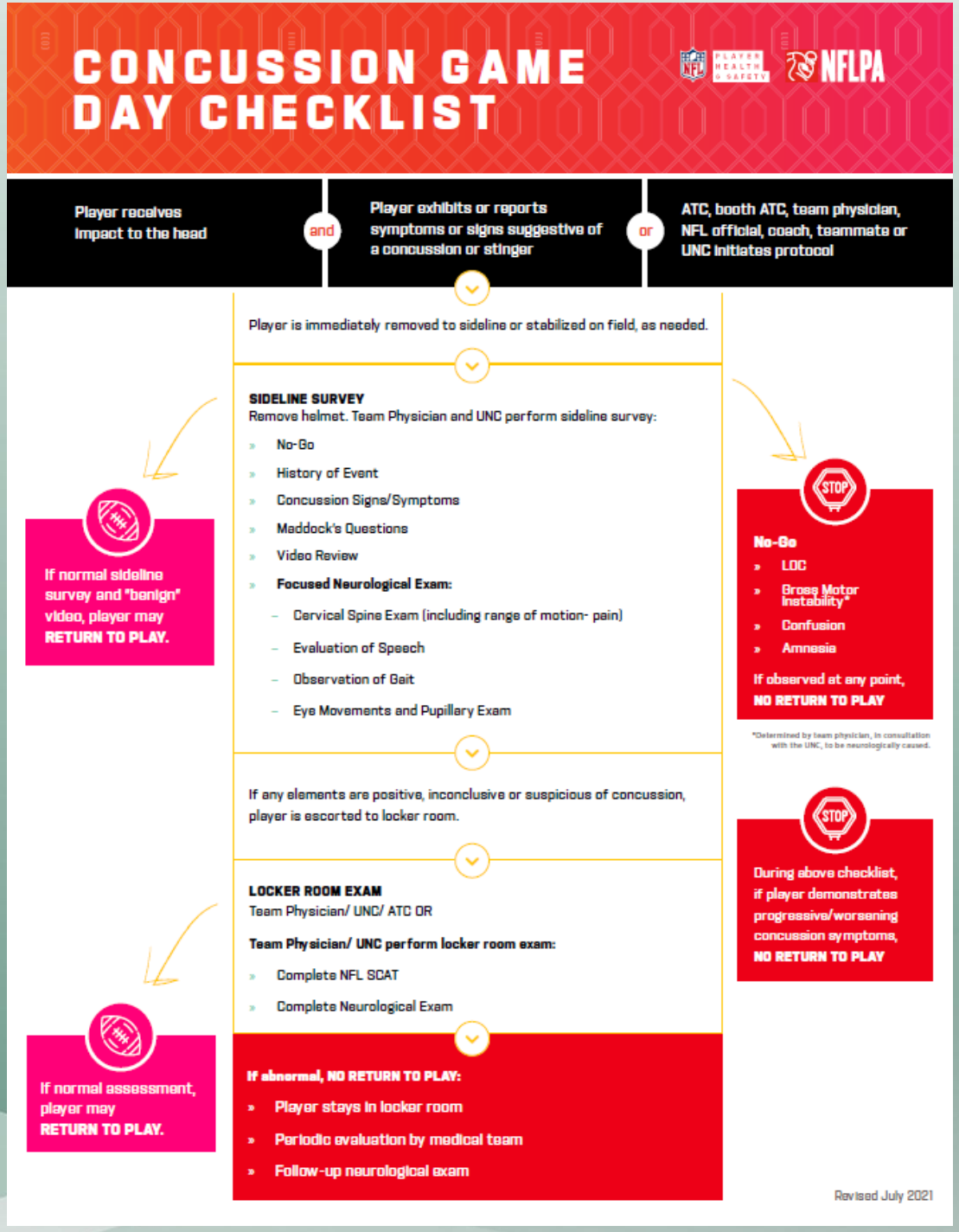

Sideline Evaluation

SCAT6™

Sport Concussion Assessment Tool

For Adolescents (13 years +) & Adults

What is the SCAT6?

The SCAT6 is a standardised tool for evaluating concussions designed for use by Health Care Professionals (HCPs). The SCAT6 cannot be performed correctly in less than 10-15 minutes. Except for the symptoms scale, the SCAT6 is intended to be used in the acute phase, ideally within 72 hours (3 days), and up to 7 days, following injury. If greater than 7 days post-injury, consider using the SCOAT6/Child SCOAT6.

> The SCAT6 is used for evaluating athletes aged 13 years and older. For children aged 12 years or younger, please use the Child SCAT6.
>
> If you are not an HCP, please use the Concussion Recognition Tool 6 (CRT6).

Preseason baseline testing with the SCAT6 can be helpful for interpreting post-injury test scores but is not required for that purpose. Detailed instructions for use of the SCAT6 are provided as a supplement. Please read through these instructions carefully before testing the athlete. Brief verbal instructions for each test are given in ***blue italics***. The only equipment required for the examiner is athletic tape and a watch or timer.

Recognise and Remove

A head impact by either a direct blow or indirect transmission of force to the head can be associated with serious and potentially fatal consequences. If there are significant concerns, which may include any of the Red Flags listed in Box 1, the athlete requires urgent medical attention, and if a qualified medical practitioner is not available for immediate assessment, then activation of emergency procedures and urgent transport to the nearest hospital or medical facility should be arranged.

Key Points

- Any athlete with suspected concussion should be REMOVED FROM PLAY, medically assessed, and monitored for injury-related signs and symptoms, including deterioration of their clinical condition.
- No athlete diagnosed with concussion should return to play on the day of injury.
- If an athlete is suspected of having a concussion and medical personnel are not immediately available, the athlete should be referred (or transported if needed) to a medical facility for assessment.
- Athletes with suspected or diagnosed concussion should not take medications such as aspirin or other anti-inflammatories, sedatives or opiates, drink alcohol or use recreational drugs and should not drive a motor vehicle until cleared to do so by a medical professional.
- Concussion signs and symptoms may evolve over time; it is important to monitor the athlete for ongoing, worsening, or the development of additional concussion-related symptoms.
- The diagnosis of concussion is a clinical determination made by an HCP.
- The SCAT6 should NOT be used by itself to make, or exclude, the diagnosis of concussion. It is important to note that an athlete may have a concussion even if their SCAT6 assessment is within normal limits.

Remember

- The basic principles of first aid should be followed: assess danger at the scene, athlete responsiveness, airway, breathing, and circulation.
- Do not attempt to move an unconscious/unresponsive athlete (other than what is required for airway management) unless trained to do so.
- Assessment for a spinal and/or spinal cord injury is a critical part of the initial on-field evaluation. Do not attempt to assess the spine unless trained to do so.
- Do not remove a helmet or any other equipment unless trained to do so safely.

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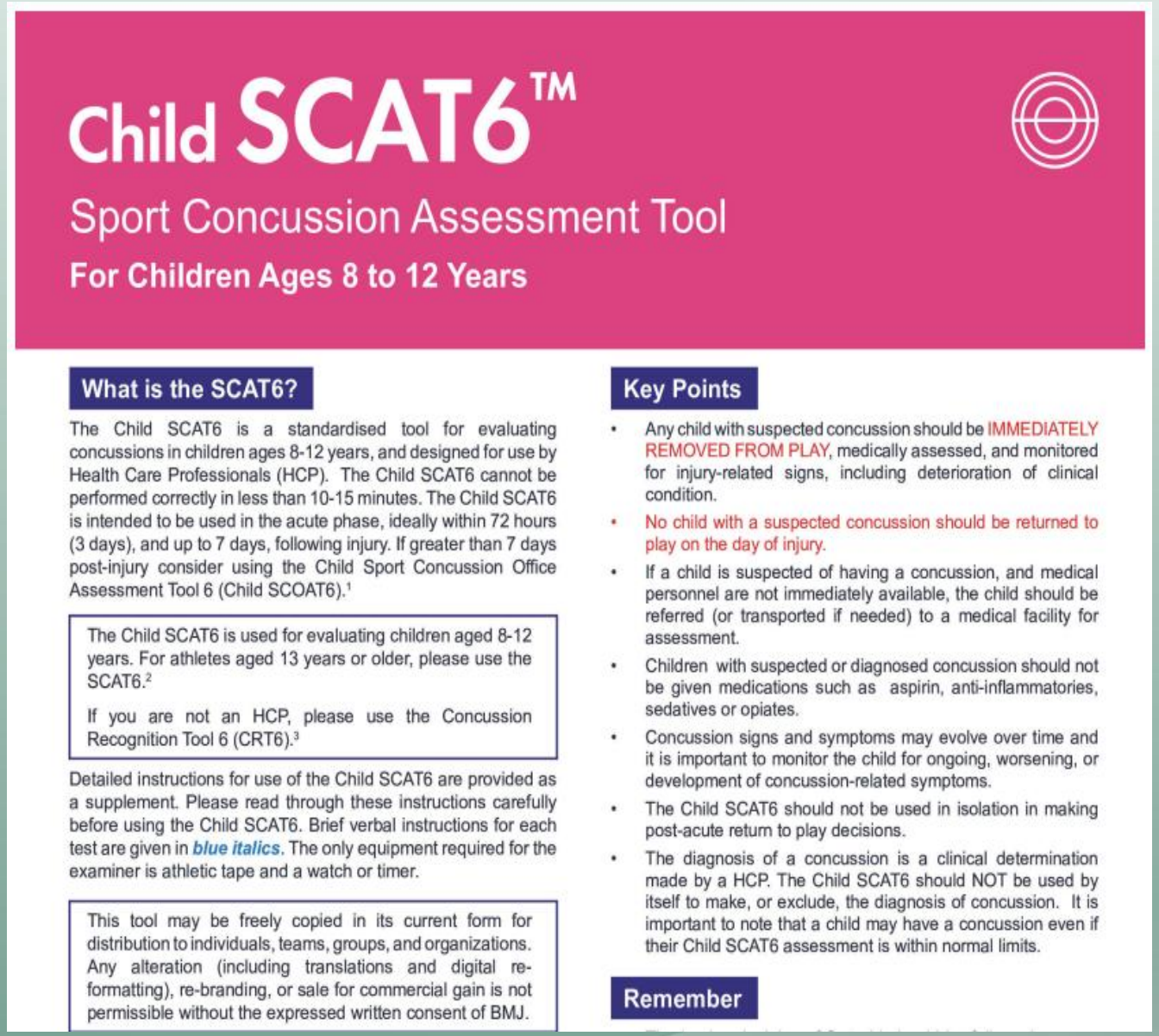
Sideline Evaluation



Child SCAT6™

Sport Concussion Assessment Tool

For Children Ages 8 to 12 Years

What is the SCAT6?

The Child SCAT6 is a standardised tool for evaluating concussions in children ages 8-12 years, and designed for use by Health Care Professionals (HCP). The Child SCAT6 cannot be performed correctly in less than 10-15 minutes. The Child SCAT6 is intended to be used in the acute phase, ideally within 72 hours (3 days), and up to 7 days, following injury. If greater than 7 days post-injury consider using the Child Sport Concussion Office Assessment Tool 6 (Child SCOAT6).[1]

The Child SCAT6 is used for evaluating children aged 8-12 years. For athletes aged 13 years or older, please use the SCAT6.[2]

If you are not an HCP, please use the Concussion Recognition Tool 6 (CRT6).[3]

Detailed instructions for use of the Child SCAT6 are provided as a supplement. Please read through these instructions carefully before using the Child SCAT6. Brief verbal instructions for each test are given in ***blue italics***. The only equipment required for the examiner is athletic tape and a watch or timer.

Key Points

- Any child with suspected concussion should be IMMEDIATELY REMOVED FROM PLAY, medically assessed, and monitored for injury-related signs, including deterioration of clinical condition.
- No child with a suspected concussion should be returned to play on the day of injury.
- If a child is suspected of having a concussion, and medical personnel are not immediately available, the child should be referred (or transported if needed) to a medical facility for assessment.
- Children with suspected or diagnosed concussion should not be given medications such as aspirin, anti-inflammatories, sedatives or opiates.
- Concussion signs and symptoms may evolve over time and it is important to monitor the child for ongoing, worsening, or development of concussion-related symptoms.
- The Child SCAT6 should not be used in isolation in making post-acute return to play decisions.
- The diagnosis of a concussion is a clinical determination made by a HCP. The Child SCAT6 should NOT be used by itself to make, or exclude, the diagnosis of concussion. It is important to note that a child may have a concussion even if their Child SCAT6 assessment is within normal limits.

Remember

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Sideline Evaluation

- ABC's first and foremost
- Concussion is important to recognize…but may not be the most important

Box 1: Red Flags

- Neck pain or tenderness
- Seizure or convulsion
- Double vision
- Loss of consciousness
- Weakness or tingling/burning in more than 1 arm or in the legs
- Deteriorating conscious state
- Vomiting
- Severe or increasing headache
- Increasingly restless, agitated or combative
- GCS <15
- Visible deformity of the skull

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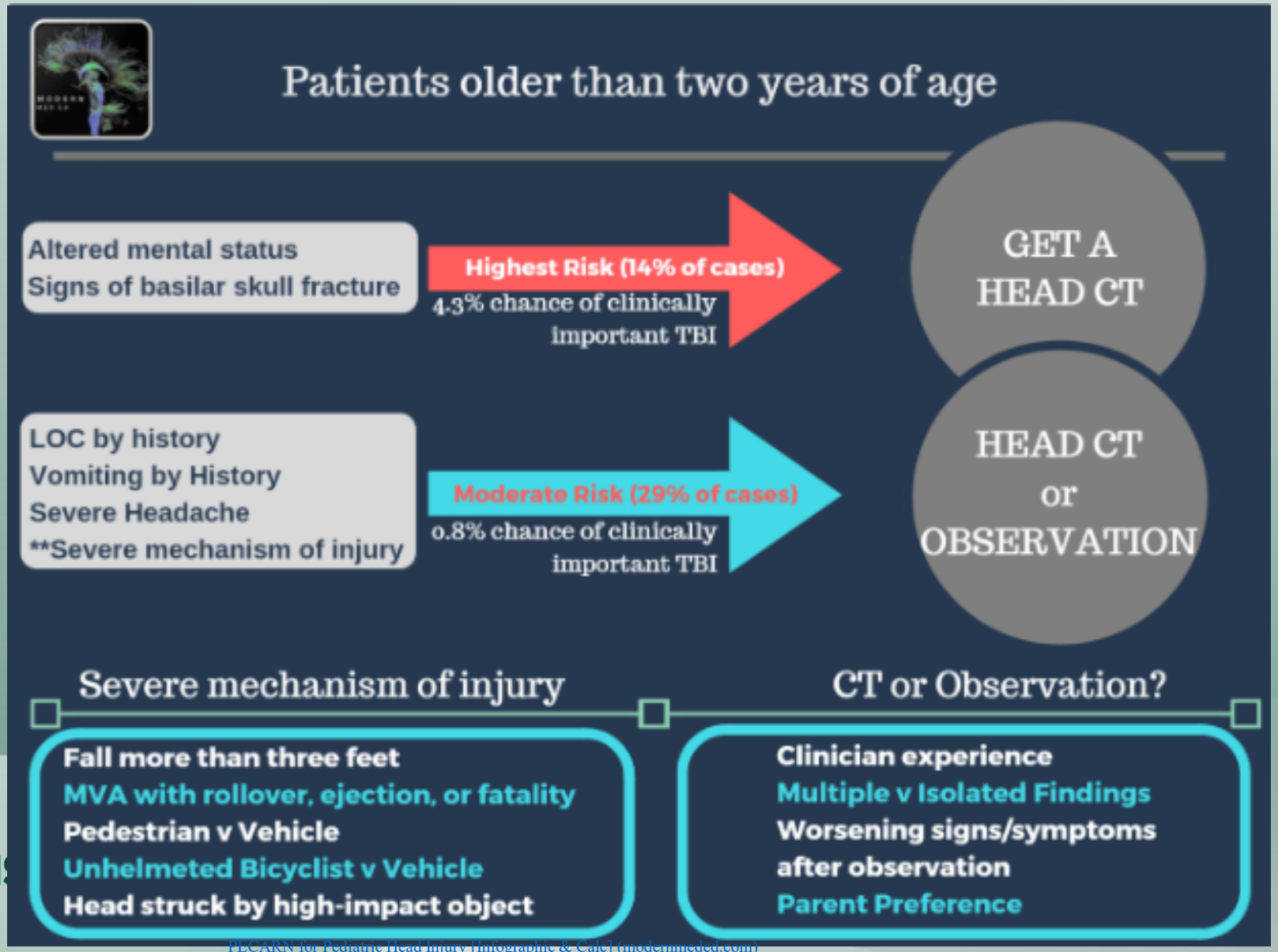
PECARN

Sensitivity: 96.8 percent

Negative Predictive Value: 99.95 percent



PECARN for Pediatric Head Injury [Infographic & Calc] (modernmedcl.com)

ATHLETE NAME:

DATE:

CERVICAL SPINE ASSESSMENT

In a patient who is **not** lucid or fully conscious, a cervical spine injury *should* be assumed and spinal precautions taken.

Does the athlete report neck pain at rest?	Y	N
Is there tenderness to palpation?	Y	N
If NO neck pain and NO tenderness, does the athlete have a full range of ACTIVE pain free movement?	Y	N
Are limb strength and sensation normal?	Y	N

COORDINATION & OCULAR/MOTOR SCREEN

Coordination: Is finger-to-nose normal for both hands with eyes open and closed?	Y	N
Ocular/Motor: Horizontal and Vertical Saccades (10s)	Y	N
Are observed extraocular eye movements normal?	Y	N
PERRLA	Y	N

POTENTIAL CONCUSSION SYMPTOMS INCLUDE:

Headache	Light/Sound Sensitivity
Dizziness or Light Headedness	Disorientation
Nausea	Visual Disturbance
Cognitive Slowness	Tinnitus

MEMORY ASSESSMENT MADDOCKS QUESTIONS

Say *"I am going to ask you a few questions, please listen carefully and give your best effort. First, tell me what happened?"*

Modified Maddocks Questions
(Modified appropriately for each sport; 1 point for each correct answer)

What venue are we at today?	0	1
Which half is it now?	0	1
Who scored last in this match?	0	1
What team did you play last week/game?	0	1
Did your team win the last game?	0	1
Maddocks Score	/5	

EVALUATION OF SPEECH/COGNITION

Immediate Memory

TRIAL 1:
Say *"I am going to test your memory. I will read you a list of words and when I am done, repeat back as many words as you can remember in any order."*

Jacket	0	1
Arrow	0	1
Pepper	0	1
Cotton	0	1
Movie	0	1
Dollar	0	1
Honey	0	1
Mirror	0	1
Saddle	0	1
Anchor	0	1
Immediate Memory Score:	/10	

TRIAL 1

EVALUATION OF SPEECH/COGNITION

Immediate Memory

TRIAL 2:
Say *"I am going to repeat the same list. Repeat back as many words as you can remember in any order, even if you said the word in a previous trial."*

Jacket	0	1
Arrow	0	1
Pepper	0	1
Cotton	0	1
Movie	0	1
Dollar	0	1
Honey	0	1
Mirror	0	1
Saddle	0	1
Anchor	0	1
Immediate Memory Score:	/10	

TRIAL 2

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EVALUATION OF SPEECH/COGNITION

Immediate Memory

TRIAL 3:

Say *"I am going to repeat the same list. Repeat back as many words as you can remember in any order, even if you said the word in a previous trial."*

Jacket	0	1
Arrow	0	1
Pepper	0	1
Cotton	0	1
Movie	0	1
Dollar	0	1
Honey	0	1
Mirror	0	1
Saddle	0	1
Anchor	0	1
Immediate Memory Score: *Total Avg. 20 (SD=3) Trial 3 Avg. 8 (SD=1)*	/10	

TRIAL 3

DELAYED RECALL

Say *"Do you remember that list of words I read a few minutes ago? Tell me as many words as you can remember in any order."*

Jacket	0	1
Arrow	0	1
Pepper	0	1
Cotton	0	1
Movie	0	1
Dollar	0	1
Honey	0	1
Mirror	0	1
Saddle	0	1
Anchor	0	1
Delayed Recall Score: *Total Avg. 6 (SD=2)*	/10	

CLEARED:

NOT CLEARED:

HELD FOR EVAL:

CONCENTRATION

Say *"I am going to read a string of numbers and when I am done, you repeat them back to me in reverse order of how I read them to you. For example, if I say 7-1-9, you would say 9-1-7. So, if I said, 9-6-8 you would say? (8-6-9)"*

4-9-3 6-2-9	0	1	6-2-9-7-1 1-5-2-8-6	0	1
3-8-1-4 3-2-7-9	0	1	7-1-8-4-6-2 5-3-9-1-4-8	0	1

Digits Score	of 4

Say *"Now tell me the months of the year in reverse order as quickly and as accurately as possible. Start with December and go backwards."*

Start stopwatch and ***CIRCLE*** each correct response:

December	November	October	September
August	July	June	May
April	March	February	January

1 point if NO errors and completion < 30 secs:	0	1
Total *(mean 3.6 +/- 1.1)*:	of 5	

EVALUATION OF GAIT/BALANCE

Modified BESS *(20 seconds each)*

Double Leg Stance *(mean 0, SD=0)*:		of 10
Tandem Stance *(mean 1, SD=1)*:		of 10
Single Leg Stance *(mean 2, SD=2)*:		of 10
Total Errors:		of 30

OBSERVABLE SIGNS

WITNESSED ☐ OBSERVED ON VIDEO ☐

Lying motionless on playing surface	Y	N
Falling unprotected to the surface	Y	N
Balance/gait difficulties, motor incoordination, ataxia: stumbling, slow/laboured movements	Y	N
Disorientation or confusion, staring or limited responsiveness, or an inability to respond appropriately to questions	Y	N
Blank or vacant look	Y	N
Facial injury after head trauma	Y	N
Impact seizure	Y	N
High-risk mechanism of injury (sport-dependent)	Y	N

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No Go Findings

- Players exhibiting these signs *should not return* to a match or training that day, *unless evaluated acutely by an experienced HCP* with a multimodal assessment (as noted below) who determines that the sign was not related to a concussion (eg, the player has sustained a musculoskeletal injury and thus unable to balance)

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Concussion Evaluation

- Perfect, we've got it……..or not
  - UW found 45% of concussed athletes scored at or above normal values for the 10-word recall

June 11, 2024

Cognitive test is poor predictor of athletes' concussion

Part of the NCAA's standardized concussion evaluation failed to distinguish athletes who were actually injured, a study shows.

Instead, the study showed that the most accurate predictor of concussion were the athletes' responses to questions about their symptoms.

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Concussion Evaluation

- Evaluation should take 10–15 min.
- Sport organizations are strongly advised to allow for at least that amount of time for an adequate evaluation and to accommodate such an assessment off-field, preferably in a quiet area away from the pressures and scrutiny of match play
- For athletes with potential signs of a concussion, any screening assessment short of a multimodal evaluation of symptoms, signs, balance, gait, neurological and cognitive changes associated with a potential concussion may be inadequate to allow continued sports participation

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Concussion Evaluation

- At any point you can stop the evaluation once the diagnosis is confirmed
  - Serial monitoring
    - For at least the first 4-6 hours

- To me the SCAT-6 is best used to prove they DON'T have a concussion

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Concussion Evaluation

- Tips
  - Use the school ATC
  - Be wary of parents
  - Controlled environment
  - You will never be wrong holding a kid out, but you can be wrong if you put them back in
  - Let the athlete know this is YOUR decision
    - Takes pressure off them to get back
    - Let them know why and let parents know why
  - Listen to your gut
  - Take their helmet

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Concussion Treatment

First 48 hours

- Avoid NSAIDS
  - Bleeding risk
- Avoid anything sedating
- After 4-5 hours ok to sleep
  - Don’t wake overnight
- Minimize screen time
- Sub-symptom threshold activity
  - Relative rest with ADL’s
  - Light physical activity
- Review red flags
- Avoid strict rest

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First Office Visit

- Determine acuity of situation
  - Indications of skull fracture or delayed brain bleed
    - Worsening headache
    - Constant runny nose
    - Worsening confusion/disorientation
    - “Overall, how do you feel since the event?”
  - Pediatric Emergency Care Applied Research Network
    - PECARN

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Concussion Management

- Important to know
  - MOI and circumstance
  - Number and severity of initial symptoms
    - Thought to be a predictor of recovery time
  - Previous concussions
    - Recovery time
    - Fully recover?
  - Overlapping co-morbid medical issues
    - Headaches
    - Mood disorders

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First Office Visit

SCOAT6™

Sport Concussion Office Assessment Tool

For Adults & Adolescents (13 years +)

Child SCOAT6™

Sport Concussion Office Assessment Tool

For Children Ages 8 to 12 Years

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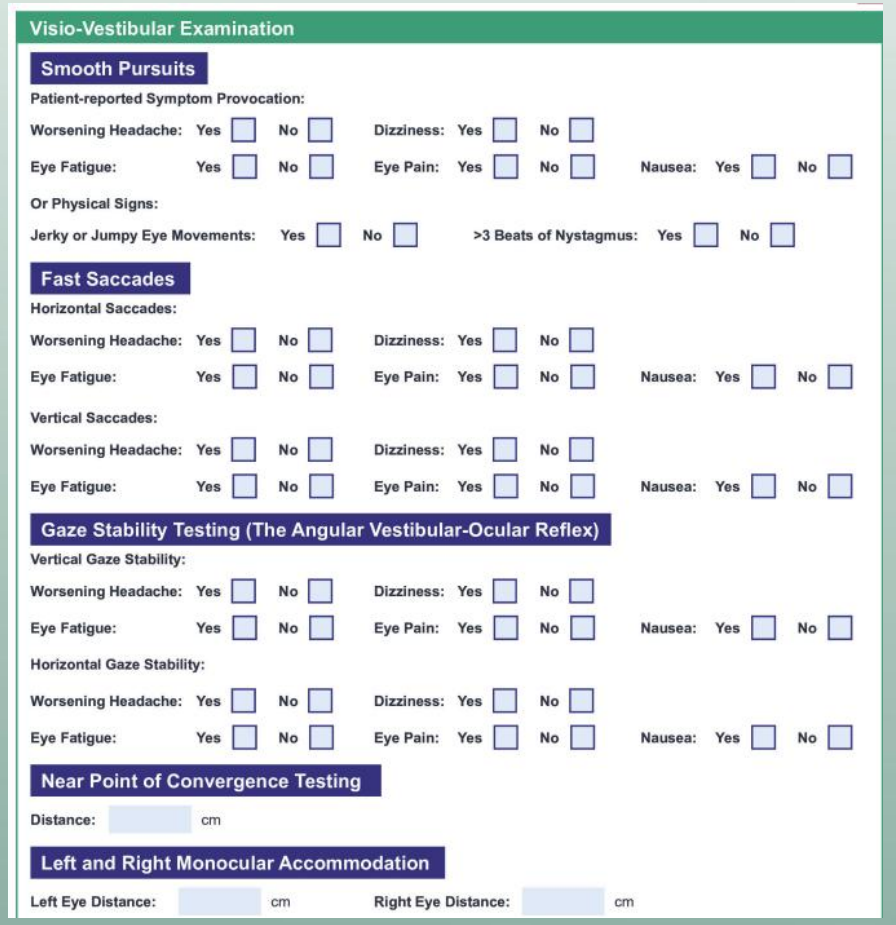
First Visit

Complete Neurological Exam, VOMS, Bess Balance Test

Talk about mood, depression, suicidality



Visio-Vestibular Examination

Smooth Pursuits

Patient-reported Symptom Provocation:

Worsening Headache: Yes ☐ No ☐ Dizziness: Yes ☐ No ☐

Eye Fatigue: Yes ☐ No ☐ Eye Pain: Yes ☐ No ☐ Nausea: Yes ☐ No ☐

Or Physical Signs:

Jerky or Jumpy Eye Movements: Yes ☐ No ☐ >3 Beats of Nystagmus: Yes ☐ No ☐

Fast Saccades

Horizontal Saccades:

Worsening Headache: Yes ☐ No ☐ Dizziness: Yes ☐ No ☐

Eye Fatigue: Yes ☐ No ☐ Eye Pain: Yes ☐ No ☐ Nausea: Yes ☐ No ☐

Vertical Saccades:

Worsening Headache: Yes ☐ No ☐ Dizziness: Yes ☐ No ☐

Eye Fatigue: Yes ☐ No ☐ Eye Pain: Yes ☐ No ☐ Nausea: Yes ☐ No ☐

Gaze Stability Testing (The Angular Vestibular-Ocular Reflex)

Vertical Gaze Stability:

Worsening Headache: Yes ☐ No ☐ Dizziness: Yes ☐ No ☐

Eye Fatigue: Yes ☐ No ☐ Eye Pain: Yes ☐ No ☐ Nausea: Yes ☐ No ☐

Horizontal Gaze Stability:

Worsening Headache: Yes ☐ No ☐ Dizziness: Yes ☐ No ☐

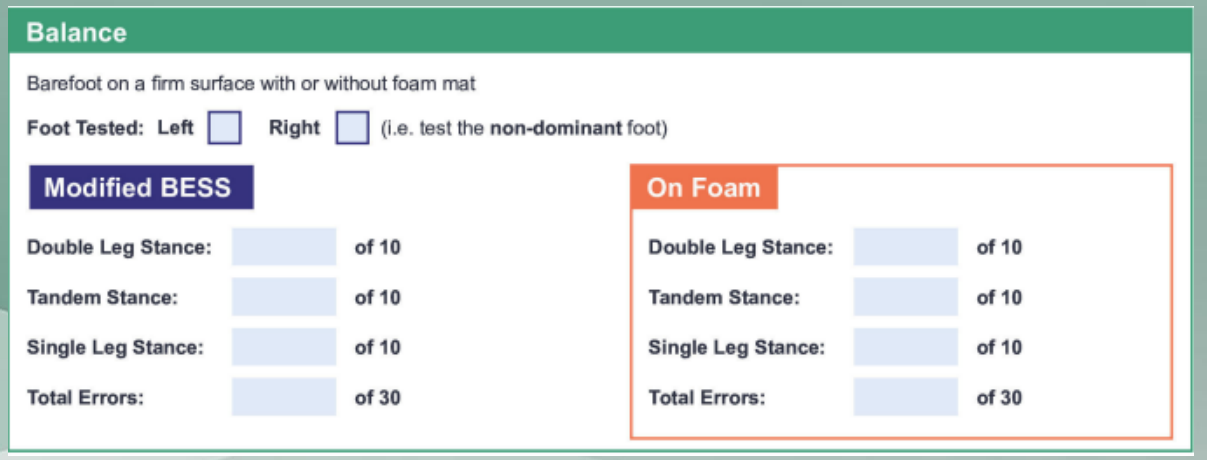
Eye Fatigue: Yes ☐ No ☐ Eye Pain: Yes ☐ No ☐ Nausea: Yes ☐ No ☐

Near Point of Convergence Testing

Distance: _____ cm

Left and Right Monocular Accommodation

Left Eye Distance: _____ cm Right Eye Distance: _____ cm



Balance

Barefoot on a firm surface with or without foam mat

Foot Tested: Left ☐ Right ☐ (i.e. test the **non-dominant** foot)

Modified BESS

Double Leg Stance:		of 10
Tandem Stance:		of 10
Single Leg Stance:		of 10
Total Errors:		of 30

On Foam

Double Leg Stance:		of 10
Tandem Stance:		of 10
Single Leg Stance:		of 10
Total Errors:		of 30

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Concussion Management

- Days 2-10
- Patients can do whatever they want following 2 rules:

1. They can't hit their heads

2. The activity can't make their symptoms worse
   - Sub Symptom Threshold Activity

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Sub-Symptom Threshold

- Ok to do activity if it does not exacerbate their current state
  - Typically say an increase by 3 or more on their subjective scale of 0-10 lasting greater than 1 hour
  - Acute, severe worsening can be addressed sooner
- Activities
  - ADL's
  - School
  - Light exercise
  - Socializing

Key is, they can do things *with* symptoms

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Initial Treatment

- Treat their symptoms
  - Headache:
    - Hydration
    - Minimize provoking behaviors
      - Sunglasses, ear plugs
    - Meditation
      - Mood
    - Nutrition
    - OMT
      - Journal of the AOA: OMM for concussions (youtube)
    - Massage
    - Limit naps to 30 min
    - Tylenol/Motrin
      - Beware of Excedrin with aspirin
      - Monitor for rebound headaches

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Return to Learn

Step	Mental Activity	Activity at Each Step	Goal
1	Daily activities that do not result in more than a mild exacerbation* of symptoms related to the current concussion.	Typical activities during the day (e.g., reading) while minimizing screen time. Start with 5–15 min at a time and increase gradually.	Gradual return to typical activities.
2	School activities.	Homework, reading, or other cognitive activities outside of the classroom.	Increase tolerance to cognitive work.
3	Return to school part time.	Gradual introduction of schoolwork. May need to start with a partial school day or with greater access to rest breaks during the day.	Increase academic activities.
4	Return to school full time.	Gradually progress school activities until a full day can be tolerated without more than mild* symptom exacerbation.	Return to full academic activities and catch up on missed work.

I will recommend early return to school. Accommodations are very important including more time for tests/assignments, alternative learning environments, alternative delivery methods, avoidance of stimulating situations

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Return to Play

24 hours at each step

Step	Exercise Strategy	Activity at Each Step	Goal
1	Symptom-limited activity.	Daily activities that do not exacerbate symptoms (e.g., walking).	Gradual reintroduction of work/school.
2	Aerobic exercise **2A – Light** (up to approx. 55% max HR) **then** **2B – Moderate** (up to approximately 70% max HR)	Stationary cycling or walking at slow to medium pace. May start light resistance training that does not result in more than mild and brief exacerbation* of concussion symptoms.	Increase heart rate.
3	Individual sport-specific exercise **NOTE:** if sport-specific exercise involves any risk of head impact, medical determination of readiness should occur prior to step 3.	Sport-specific training away from the team environment (e.g., running, change of direction and/or individual training drills away from the team environment). No activities at risk of head impact.	Add movement, change of direction.
Steps 4-6 should begin after resolution of any symptoms, abnormalities in cognitive function, and any other clinical findings related to the current concussion, including with and after physical exertion.			
4	Non-contact training drills.	Exercise to high intensity including more challenging training drills (e.g., passing drills, multiplayer training). Can integrate into team environment.	Resume usual intensity of exercise, coordination, and increased thinking.
5	Full contact practice.	Participate in normal training activities.	Restore confidence and assess functional skills by coaching staff.
6	Return to sport.	Normal game play.	

Can do with symptoms

Must be symptom free

maxHR = predicted maximal Heart Rate according to age (i.e., 220-age)

Age Predicted Maximal HR= 220-age	Mild Aerobic Exercise	Moderate Aerobic Exercise
55%	220-age x 0.55 = training target HR	
70%		220-age x 0.70 = training target HR

Concussion Management

- At Day 10
  - Continue days 2-10 treatment

- Get to local PT that is comfortable treating concussions
  - Cervico-Vestibular Rehab

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After 4 weeks

- Refer to multidisciplinary center or location with familiarity in treating these types of cases
- Likely will need multiple therapies to treat
- If still symptomatic after PT then refer out

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Concussion Terminology

- Concussion
  - Typically, anything less than 2 weeks for adults and less then 4 weeks for a child
- Progresses to:
  - Persistent Post Concussive Symptoms (current)
  - Post Concussion Syndrome (dated)

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Address Pressing Symptoms

- Headaches
  - PT
  - OMM
  - OT
  - PMR
  - Medication management
  - OD
- Dizziness
  - OD/vision therapy
  - Vertigo
- Autonomic Dysfunction
  - Daily strategies
- Memory/Recall
  - Speech therapy
- Mood
  - Psychology
  - Neuropsychology
- Neurofatigue
  - OD/Vision
  - Endocrinology
  - Medication
  - Diet
  - Exercise

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Concussion Clearance

- Symptoms have returned completely to baseline
  - Not always easy
    - Doesn't mean symptom score is all 0's
    - Headaches can be challenging
      - Post traumatic headaches
      - Pre-morbid headaches/migraines
  - Must relay on patient, family members, ATC's
    - Also, indirectly through school performance, relationships..etc
  - Nothing can bother them
    - Fine with screens, school, lights, sounds, exercise
- Completed the Return to Play Protocol up through the non-contact portion
- Cleared to return contact practice and if goes fine then cleared for all contact activity

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Concussion Clearance

- Get real with them
  - Theoretical risk of second impact syndrome
  - Return and worsening of symptoms
  - Prolonged symptoms
  - More missed game play

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Long Term Impact

- *Studies that examined mental health as an outcome found that (1) former amateur athletes (primarily American football players) are not at increased risk for depression or suicidality during early adulthood or as older adults, [50–54] (2) former professional soccer players are not at increased risk for psychiatric hospitalisation during their adult life [55] and (3) former professional football and soccer players are not at increased risk for death associated with having a psychiatric disorder [56 57] or as a result of suicide. [55–59]*
- *Other studies evaluated cognitive impairment, neurological disorders (eg, dementia) and neurodegenerative diseases (e.g., Alzheimer's disease, Parkinson's disease and amyotrophic lateral sclerosis (ALS)) as the outcome. Former male amateur athletes were not at increased risk for cognitive impairment, neurological disorders or neurodegenerative diseases compared with men from the general population. [53 60–62] In contrast, studies of former professional athletes examining causes of death reported greater mortality rates from neurological diseases and dementia in former professional American football players [63–65] and professional soccer players. [66]*
- *Former professional football players [64 65] and soccer players [59 66 67] have greater mortality rates from ALS. ALS is a rare disease with a possible genetic cause in some cases of men who develop the disease before age 50, [68] and it involves a highly selective population of neurons, about half of which are in the spinal cord, which makes identifying specific trauma-related mechanisms challenging.*

Overall, amateur athletes were not at greater risk for depression, any psychiatric disorder or suicidality

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Professional football and soccer players have a greater mortality rate of ALS

Long Term Impact

- Chronic Traumatic Encephalopathy (CTE)
  - Now termed CTE-NC
    - Neuropathic Changes
      - Setting a strict criteria

It is reasonable to consider extensive exposure to repetitive head impacts, such as that experienced by some professional athletes, as potentially associated with the development of the specific neuropathology described as CTE-NC.

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Concussion in Youth

1. **Esterov et al. (2023)** found that while traumatic brain injury (TBI) before age 10 was not significantly associated with an increased risk of mood disorders overall, females who sustained a TBI had a significantly increased risk of developing mood disorders compared to their age-matched female counterparts without TBI.[1]

2. **Esterov et al. (2022)** identified that older age at the time of initial TBI and the presence of extracranial injuries were significant risk factors for developing mood disorders. Specifically, children older than 5 years at the time of injury had a higher risk of mood disorders.[2]

3. **Delmonico et al. (2024)** reported that children with mild traumatic brain injuries (mTBIs) had a significantly increased risk of developing affective disorders, particularly within the first three years post-injury. The highest risk was observed in children aged 10-13 years.[3]

4. **Russell et al. (2023)** demonstrated that adolescents with a history of concussion had an increased risk of developing mood disorders, with a hazard ratio of 1.30 compared to those without a concussion.[4]

5. **Ledoux et al. (2022)** found that children and youths with a concussion had a higher incidence of mental health problems, including mood disorders, compared to those with orthopedic injuries.[5]

In summary, **children under the age of 12 who sustain a concussion are at an increased risk of developing mood disorders**, with factors such as older age at injury and female sex contributing to this risk. Early identification and ongoing monitoring for mood disorders in this population are crucial for optimizing long-term outcomes.

Concussion Risk

- The American Medical Society for Sports Medicine also states that a history of concussion is associated with a 2 to 5.8 times higher risk of sustaining another concussion

- This increased risk is particularly notable in the first 10 days following the initial concussion, as supported by pathophysiologic studies

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Retirement

- Number of concussions
- Ease of occurrence
- Duration and severity of symptoms
- Proximity to one another
- Risk of uncertainties
- Benefits of sport

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Concussion High Yield

- Rule out Red Flags
- Days 0-2
  - Relative rest
  - Avoid strict rest
  - No screens
- Days 2-10
  - RTP Protocol
  - RTL Protocol
- Day 10
  - Refer to PT if needed
- Day 28
  - Multidisciplinary center
    - PT/OT/Speech
    - OD
    - Psych/NeuroPsych
    - PMR/Endo
    - 504 Plan
- Clearance
  - Ensure back to baseline in all aspects
  - Questioning must be specific

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Concussion High Yield

- No device is yet to prevent concussion
- Retirement considers many elements
- ImPact Test
  - Great if you have it
- Baseline SCAT-6
  - Great if you have it

- 80-90% within 4 weeks
- 96% withing 8 weeks
- Don’t Assume Recovery!

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Questions

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