

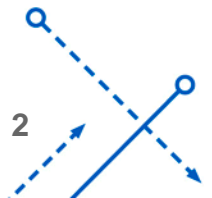


# CONCUSSION AWARENESS, MANAGEMENT, AND ASSESSMENT FROM AN ATHLETIC TRAINER

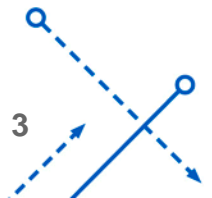
Dr. Ryan Krzyzanowicz, DAT, ATC  
Clinical Associate Professor  
Program Director - Athletic Training Education  
University at Buffalo

## Objectives for Today

- Understand what an athletic trainer is and what they do
- Define sport related concussion including signs and symptoms
- Understand the role of an Athletic Trainer in managing and assessing concussions

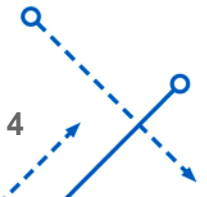


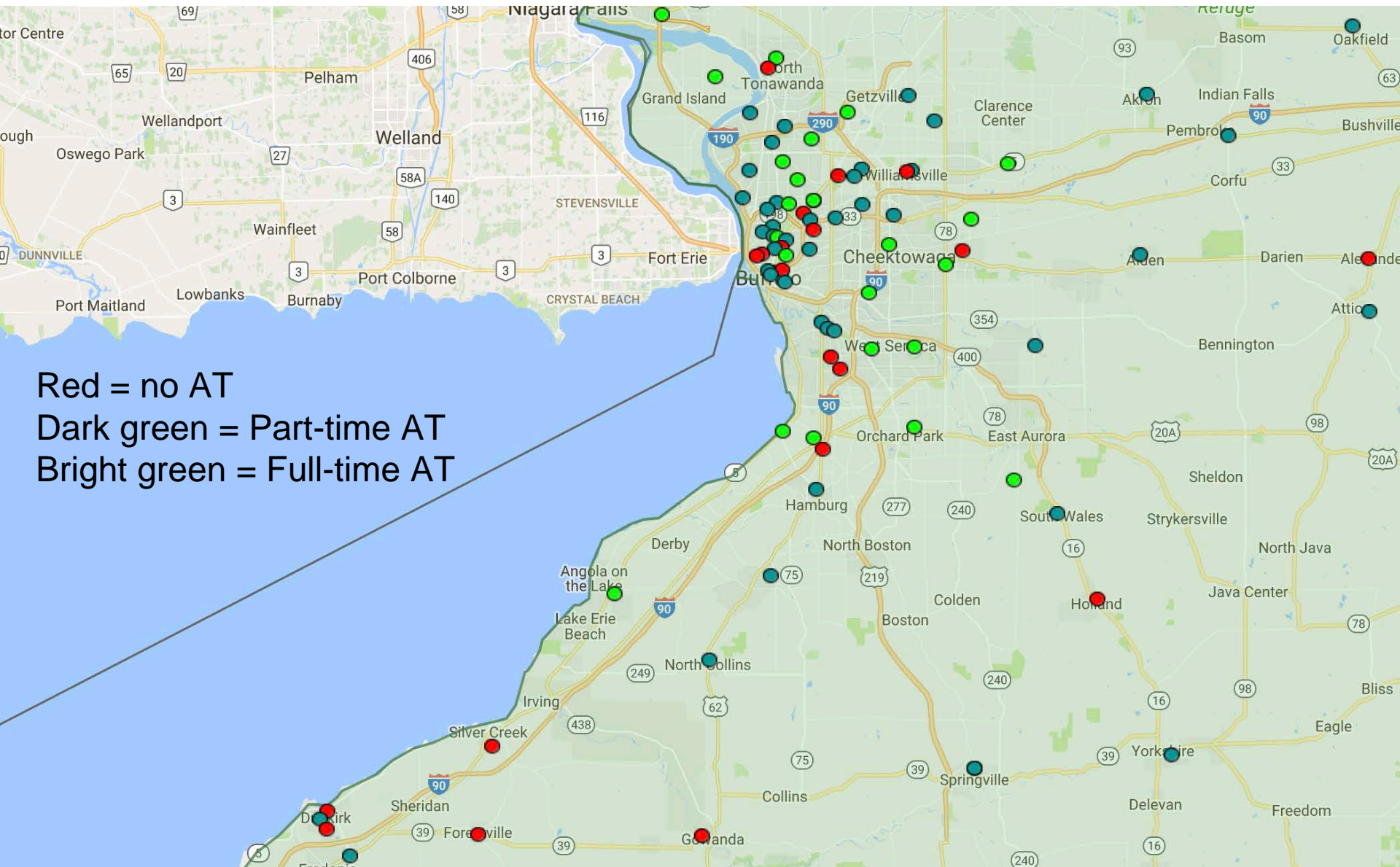
## Who is the Athletic Trainer?



## What is an Athletic Trainer?

- Healthcare provider that specializes in care and prevention of injuries in the physically active, including athletes
- Prevention, assessment and management of injuries
  - Prevent = taping, bracing, programs to decrease risk
  - Assessment = initial evaluation of orthopaedic injuries, but also general medical issues
  - Management = rehabilitation, but also referral when warranted
- Beginning in 2022 must at minimum have a Masters degree
  - Currently must have a bachelors degree, with over 75% having a Masters degree





Red = no AT  
Dark green = Part-time AT  
Bright green = Full-time AT

## Concussion Statistics

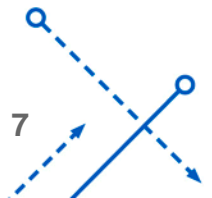
- In 2017 15.1% (2.5 million) high school students reported having at least 1 concussion during the past 12 months; 6% reported 2 or more and is significantly more prevalent in males (DePadilla, 2018 and CDC)
- Students in grades 9, 10 and 11 are more likely to report a single concussion than students in grade 12 (DePadilla, 2018)
- 22.9% of students who played on two sports teams reported having at least one concussion; 30.3% of students who played on three sports teams reported at least one concussion (DePadilla, 2018)



## What is a Sport Related Concussion (SRC)?

- A SRC is a traumatic brain injury induced by biomechanical forces. Several common features that may be utilized in clinically defining the nature include:
  - SRC may be caused by either a direct blow to the head, face, neck or elsewhere on the body with an impulsive force transmitted to the head.
  - SRC typically results in rapid onset of short-lived impairment of neurological function that resolves spontaneously. However, in some cases, signs & symptoms evolve over a number of minutes to hours.

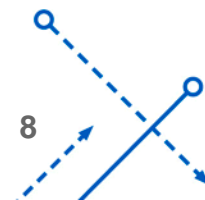
McCrory et al. 2017



## What is a Sport Related Concussion (SRC)?

- A SRC is a traumatic brain injury induced by biomechanical forces. Several common features that may be utilized in clinically defining the nature include:
  - SRC may result in neuropathological changes, but the acute clinical signs & symptoms largely reflect functional disturbance and as such, no abnormality is seen on standard neuroimaging studies.
  - SRC results in a range of clinical signs & symptoms that may or may not involve loss of consciousness. Resolution of clinical and cognitive features typically follows a sequential course. However, in some cases symptoms may be prolonged.

McCrory et al. 2017





## Symptoms of Sport Related Concussion

- Headache
- “Pressure in head”
- Neck pain
- Nausea or vomiting
- Dizziness
- Blurred Vision
- Balance Problems
- Sensitivity to light
- Sensitivity to noise
- Feeling slowed down
- Feeling like “in a fog”
- “Don’t feel right”
- Difficulty concentrating
- Difficulty remembering
- Fatigue or low energy
- Confusion
- Drowsiness
- More emotional
- Irritability
- Sadness
- Nervous or anxious
- Trouble falling asleep



## What is the Athletic Trainers' Role in SRC?

- Initial evaluation both on-field and off-field
  - If major red flags, stop and refer to Emergency Department
  - If no major red flags, setup appointment with team physician
- Management
  - Manage gradual return to play/sport activities
  - Manage gradual return to learn
  - Referral back to team physician for clearance (both sport and academic)
- Constant communication with physician(s)



## What happens after you suspect a SRC?

- REMOVE player from event/game/etc.
- Have a licensed healthcare provider perform an evaluation
  - Athletic Trainer
- If no licensed healthcare provider is available
  - Referral to physician
- Once first aid issues are addressed, assessment is made using the SCAT5 or other sideline assessment tools
- Patient should not be left alone after injury and monitoring for deterioration is essential over the initial few hours after injury
- A player diagnosed with SRC should **not** be allowed to return to play/activity on day of injury

McCrory et al. 2017



# SCAT5 (Sport Concussion Assessment Tool)

## SCAT5<sup>©</sup>

SPORT CONCUSSION ASSESSMENT TOOL – 5TH EDITION

DEVELOPED BY THE CONCUSSION IN SPORT GROUP  
FOR USE BY MEDICAL PROFESSIONALS ONLY

supported by



FIFA<sup>®</sup>



FEI

- SCAT5 is a standardized tool for evaluating concussions designed for use by physicians and licensed healthcare professionals.
  - It CANNOT be performed correctly in less than 10 minutes
  - Meant to be used to evaluate patients 13 years and older
  - Children 12 years or younger use the Child SCAT5



## Immediate Major Red Flags

- Neck pain or tenderness
- Double vision
- Weakness or tingling/burning in arms or legs
- Severe or increasing headache
- Seizure or convulsions
- Loss of consciousness
- Deteriorating conscious state
- Vomiting
- Increasingly restless, agitated or combative



## STEP 2: OBSERVABLE SIGNS

Witnessed  Observed on Video

Lying motionless on the playing surface	Y	N
Balance / gait difficulties / motor incoordination: stumbling, slow / laboured movements	Y	N
Disorientation or confusion, or an inability to respond appropriately to questions	Y	N
Blank or vacant look	Y	N
Facial injury after head trauma	Y	N

## STEP 3: MEMORY ASSESSMENT MADDOCKS QUESTIONS<sup>2</sup>

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

---



---

**Mark Y for correct answer / N for incorrect**

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

**Note: Appropriate sport-specific questions may be substituted.**

# Immediate SCAT 5

Echemendia et al.  
2017



# STEP 4: EXAMINATION

## GLASGOW COMA SCALE (GCS)<sup>3</sup>

<b>Time of assessment</b>			
<b>Date of assessment</b>			

### Best eye response (E)

No eye opening	1	1	1
Eye opening in response to pain	2	2	2
Eye opening to speech	3	3	3
Eyes opening spontaneously	4	4	4

### Best verbal response (V)

No verbal response	1	1	1
Incomprehensible sounds	2	2	2
Inappropriate words	3	3	3
Confused	4	4	4
Oriented	5	5	5

### Best motor response (M)

No motor response	1	1	1
Extension to pain	2	2	2
Abnormal flexion to pain	3	3	3
Flexion / Withdrawal to pain	4	4	4
Localizes to pain	5	5	5
Obeys commands	6	6	6
<b>Glasgow Coma score (E + V + M)</b>			



# Immediate SCAT 5

Echemendia et al.  
2017



# Off-Field SCAT 5

Echemendia et al.  
2017

## STEP 1: ATHLETE BACKGROUND

Sport / team / school: \_\_\_\_\_

Date / time of injury: \_\_\_\_\_

Years of education completed: \_\_\_\_\_

Age: \_\_\_\_\_

Gender: M / F / Other

Dominant hand: left / neither / right

How many diagnosed concussions has the athlete had in the past?: \_\_\_\_\_

When was the most recent concussion?: \_\_\_\_\_

How long was the recovery (time to being cleared to play) from the most recent concussion?: \_\_\_\_\_ (days)

### Has the athlete ever been:

Hospitalized for a head injury?	Yes	No
Diagnosed / treated for headache disorder or migraines?	Yes	No
Diagnosed with a learning disability / dyslexia?	Yes	No
Diagnosed with ADD / ADHD?	Yes	No
Diagnosed with depression, anxiety or other psychiatric disorder?	Yes	No

Current medications? If yes, please list:







# Off-Field SCAT 5

Echemendia et al.  
2017

## STEP 2: SYMPTOM EVALUATION

The athlete should be given the symptom form and asked to read this instruction paragraph out loud then complete the symptom scale. For the baseline assessment, the athlete should rate his/her symptoms based on how he/she typically feels and for the post injury assessment the athlete should rate their symptoms at this point in time.

Please Check:  Baseline  Post-Injury

Please hand the form to the athlete

	none	mild		moderate		severe		
Headache	0	1	2	3	4	5	6	
"Pressure in head"	0	1	2	3	4	5	6	
Neck Pain	0	1	2	3	4	5	6	
Nausea or vomiting	0	1	2	3	4	5	6	
Dizziness	0	1	2	3	4	5	6	
Blurred vision	0	1	2	3	4	5	6	
Balance problems	0	1	2	3	4	5	6	
Sensitivity to light	0	1	2	3	4	5	6	
Sensitivity to noise	0	1	2	3	4	5	6	
Feeling slowed down	0	1	2	3	4	5	6	
Feeling like "in a fog"	0	1	2	3	4	5	6	
"Don't feel right"	0	1	2	3	4	5	6	
Difficulty concentrating	0	1	2	3	4	5	6	
Difficulty remembering	0	1	2	3	4	5	6	
Fatigue or low energy	0	1	2	3	4	5	6	
Confusion	0	1	2	3	4	5	6	
Drowsiness	0	1	2	3	4	5	6	
More emotional	0	1	2	3	4	5	6	
Irritability	0	1	2	3	4	5	6	
Sadness	0	1	2	3	4	5	6	
Nervous or Anxious	0	1	2	3	4	5	6	
Trouble falling asleep (if applicable)	0	1	2	3	4	5	6	
Total number of symptoms:							of 22	
Symptom severity score:							of 132	
Do your symptoms get worse with physical activity?							Y	N
Do your symptoms get worse with mental activity?							Y	N
If 100% is feeling perfectly normal, what percent of normal do you feel?								





# Off-Field SCAT 5

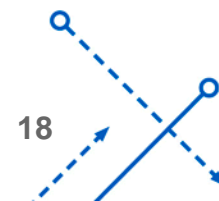
## STEP 3: COGNITIVE SCREENING

### Standardised Assessment of Concussion (SAC)<sup>4</sup>

#### ORIENTATION

What month is it?	0	1
What is the date today?	0	1
What is the day of the week?	0	1
What year is it?	0	1
What time is it right now? (within 1 hour)	0	1
<b>Orientation score</b>	<b>of 5</b>	

Echemendia et al.  
2017





### IMMEDIATE MEMORY

The Immediate Memory component can be completed using the traditional 5-word per trial list or optionally using 10-words per trial to minimise any ceiling effect. All 3 trials must be administered irrespective of the number correct on the first trial. Administer at the rate of one word per second.

Please choose EITHER the 5 or 10 word list groups and circle the specific word list chosen for this test.

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. For Trials 2 & 3: I am going to repeat the same list again. Repeat back as many words as you can remember in any order, even if you said the word before.

# Off-Field SCAT 5

Echemendia et al.  
2017

List	Alternate 5 word lists					Score (of 5)		
						Trial 1	Trial 2	Trial 3
A	Finger	Penny	Blanket	Lemon	Insect			
B	Candle	Paper	Sugar	Sandwich	Wagon			
C	Baby	Monkey	Perfume	Sunset	Iron			
D	Elbow	Apple	Carpet	Saddle	Bubble			
E	Jacket	Arrow	Pepper	Cotton	Movie			
F	Dollar	Honey	Mirror	Saddle	Anchor			
<b>Immediate Memory Score</b>						of 15		
<b>Time that last trial was completed</b>								

List	Alternate 10 word lists					Score (of 10)		
						Trial 1	Trial 2	Trial 3
G	Finger	Penny	Blanket	Lemon	Insect			
	Candle	Paper	Sugar	Sandwich	Wagon			
H	Baby	Monkey	Perfume	Sunset	Iron			
	Elbow	Apple	Carpet	Saddle	Bubble			
I	Jacket	Arrow	Pepper	Cotton	Movie			
	Dollar	Honey	Mirror	Saddle	Anchor			
<b>Immediate Memory Score</b>						of 30		
<b>Time that last trial was completed</b>								





CONCENTRATION

DIGITS BACKWARDS

Please circle the Digit list chosen (A, B, C, D, E, F). Administer at the rate of one digit per second reading DOWN the selected column.

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.

Concentration Number Lists (circle one)					
List A	List B	List C			
4-9-3	5-2-6	1-4-2	Y	N	0
6-2-9	4-1-5	6-5-8	Y	N	1
3-8-1-4	1-7-9-5	6-8-3-1	Y	N	0
3-2-7-9	4-9-6-8	3-4-8-1	Y	N	1
6-2-9-7-1	4-8-5-2-7	4-9-1-5-3	Y	N	0
1-5-2-8-6	6-1-8-4-3	6-8-2-5-1	Y	N	1
7-1-8-4-6-2	8-3-1-9-6-4	3-7-6-5-1-9	Y	N	0
5-3-9-1-4-8	7-2-4-8-5-6	9-2-6-5-1-4	Y	N	1
List D	List E	List F			
7-8-2	3-8-2	2-7-1	Y	N	0
9-2-6	5-1-8	4-7-9	Y	N	1
4-1-8-3	2-7-9-3	1-6-8-3	Y	N	0
9-7-2-3	2-1-6-9	3-9-2-4	Y	N	1
1-7-9-2-6	4-1-8-6-9	2-4-7-5-8	Y	N	0
4-1-7-5-2	9-4-1-7-5	8-3-9-6-4	Y	N	1
2-6-4-8-1-7	6-9-7-3-8-2	5-8-6-2-4-9	Y	N	0
8-4-1-9-3-5	4-2-7-9-3-8	3-1-7-8-2-6	Y	N	1
<b>Digits Score:</b>					of 4

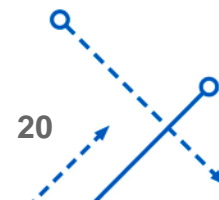
# Off-Field SCAT 5

Echemendia et al.  
2017

## MONTHS IN REVERSE ORDER

Now tell me the months of the year in reverse order. Start with the last month and go backward. So you'll say December, November. Go ahead.

Dec - Nov - Oct - Sept - Aug - Jul - Jun - May - Apr - Mar - Feb - Jan	0 1
<b>Months Score</b>	of 1
<b>Concentration Total Score (Digits + Months)</b>	of 5





# STEP 4: NEUROLOGICAL SCREEN

See the instruction sheet (page 7) for details of test administration and scoring of the tests.

## Off-Field SCAT 5

Can the patient read aloud (e.g. symptom checklist) and follow instructions without difficulty?	Y	N
Does the patient have a full range of pain-free PASSIVE cervical spine movement?	Y	N
Without moving their head or neck, can the patient look side-to-side and up-and-down without double vision?	Y	N
Can the patient perform the finger nose coordination test normally?	Y	N
Can the patient perform tandem gait normally?	Y	N

Echemendia et al.  
2017

## BALANCE EXAMINATION

### Modified Balance Error Scoring System (mBESS) testing<sup>5</sup>

Which foot was tested (i.e. which is the non-dominant foot)  Left  Right

Testing surface (hard floor, field, etc.) \_\_\_\_\_

Footwear (shoes, barefoot, braces, tape, etc.) \_\_\_\_\_

Condition	Errors
<b>Double leg stance</b>	of 10
<b>Single leg stance (non-dominant foot)</b>	of 10
<b>Tandem stance (non-dominant foot at the back)</b>	of 10
<b>Total Errors</b>	of 30



## Off-Field SCAT 5

### STEP 5: DELAYED RECALL:

The delayed recall should be performed after 5 minutes have elapsed since the end of the Immediate Recall section. Score 1 pt. for each correct response.

*Do you remember that list of words I read a few times earlier? Tell me as many words from the list as you can remember in any order.*

**Time Started**

Echemendia et al.  
2017

Please record each word correctly recalled. Total score equals number of words recalled.

---

---

---

**Total number of words recalled accurately:**

of 5

or

of 10



# Off-Field SCAT 5

## STEP 6: DECISION

Domain	Date & time of assessment:		
Symptom number (of 22)			
Symptom severity score (of 132)			
Orientation (of 5)			
Immediate memory	of 15 of 30	of 15 of 30	of 15 of 30
Concentration (of 5)			
Neuro exam	Normal Abnormal	Normal Abnormal	Normal Abnormal
Balance errors (of 30)			
Delayed Recall	of 5 of 10	of 5 of 10	of 5 of 10

Date and time of injury: \_\_\_\_\_

If the athlete is known to you prior to their injury, are they different from their usual self?

Yes  
  No  
  Unsure  
  Not Applicable

(If different, describe why in the clinical notes section)

Concussion Diagnosed?

Yes  
  No  
  Unsure  
  Not Applicable

If re-testing, has the athlete improved?

Yes  
  No  
  Unsure  
  Not Applicable

**I am a physician or licensed healthcare professional and I have personally administered or supervised the administration of this SCAT5.**

Signature: \_\_\_\_\_

Name: \_\_\_\_\_

Title: \_\_\_\_\_

Registration number (if applicable): \_\_\_\_\_

Date: \_\_\_\_\_



**SCORING ON THE SCAT5 SHOULD NOT BE USED AS A STAND-ALONE METHOD TO DIAGNOSE CONCUSSION, MEASURE RECOVERY OR MAKE DECISIONS ABOUT AN ATHLETE'S READINESS TO RETURN TO COMPETITION AFTER CONCUSSION.**

Echemendia et al.  
2017





## Neuropsychological Assessment

- Neuropsychological assessments, such as the ImPact test, have been shown to have clinical value as another tool to aid in return to play decisions
- Neuropsychological assessments should not be the sole basis of management decisions!
  - Helps the clinical decision-making process
- Pre-Post test results
  - Baseline assessment and assessment following concussion
- Make sure, if possible, a neuropsychologist interprets the test
- Computerized testing is often done at secondary schools, but issues remain
  - Mainly due to errors in testing (i.e., all students in one computer lab)
  - Errors in interpretation of tests (not using neuropsychologist)

McCrory et al. 2017



## Rest

- Most consensus statements for managing SRC recommend rest until symptom free.
- However, there is insufficient evidence that prescribing complete rest achieves an ease in discomfort nor promote recovery by minimizing brain energy demands.
- Buffalo Concussion Treadmill Test has shown that concussed patients can exercise, without an increase in symptoms. Especially patients with post-concussion syndrome
  - Dr. Leddy leads this research

McCrory et al. 2017

Leddy et al. 2010



## Rehabilitation

- Biggest “unknown” currently in the literature - need more research focused on this area
- A variety of treatments such as manual therapy, balance training, education and cognitive behavior therapy have shown efficacy in certain patients
- Ideally, sub-symptom and sub-maximal exercise has been shown to be safe and of possible benefit to the patient
  - Buffalo Concussion Treadmill Test
- Finally, a collaborative approach including controlling stress, pharmacological treatment and school accommodations may be beneficial

## Refer

- Persistent Symptoms = refer back to physician
  - Symptoms that persist beyond expect time frames (>10-14 days in adults and >4 weeks in children)
  - Could result in post-concussion syndrome (PCS)
- Athletic Trainer can make this referral back to physician and will be in constant communication with physician(s)





# Graduated Return to Play Strategy

Stage	Aim	Activity	Goal of each step
1	Symptom-limited activity	Daily activities that do not provoke symptoms	Gradual reintroduction of work/school activities
2	Light aerobic exercise	Walking or stationary cycling at slow to medium pace. No resistance training	Increase heart rate
3	Sport-specific exercise	Running or skating drills. No head impact activities	Add movement
4	Non-contact training drills	Harder training drills, e.g., passing drills. May start progressive resistance training	Exercise, coordination and increased thinking
5	Full contact practice	Following medical clearance, participate in normal training activities	Restore confidence and assess functional skills by coaching staff
6	Return to sport	Normal game play	

# Graduated Return-to-School Strategy

Stage	Aim	Activity	Goal of each step
1	Daily activities at home that do not give child symptoms	Typical activities of the child during the day as long as they do not increase symptoms (e.g., reading, texting, screen time). Start with 5-15 min at a time and gradually build up	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 increased breaks during the day	Increase academic activities
4	Return to school full time	Gradually progress school activities until a full day can be tolerated	Return to full academic activities and catch up on missed work



## Questions?



Ryan Krzyzanowicz, DAT, ATC  
Program Director - AT Education  
University at Buffalo  
[ryankrzy@buffalo.edu](mailto:ryankrzy@buffalo.edu)