SPORT CONCUSSION UPDATE

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DISCLOSURES

I have no relevant financial disclosures related to this presentation.

LEARNING OBJECTIVES

At the conclusion of this presentation, the participant should be able to:

1. Summarize changes in the acute diagnosis of Sport-Related Concussion utilizing the SCAT6 tool.

2. Explain the role of the SCOAT6 tool in concussion assessment, treatment, and return to play.

3. Implement changes to clinical practice including the role of aerobic exercise in the treatment of Sport-Related Concussion.

HISTORY OF CONCUSSION CONSENSUS

Expert Opinion

- 2001 & 2004

Evolved into Evidence Informed Consensus

- Highest Scientific Standards

- Structured Format

- Consensus=80% Agreement

- Widely Disseminated
  - Materials Available for Free
  - Minimal Technology Need

- Reconvene every 4 years
  - 2008, 2012, 2016, 2022

Consensus statement on concussion in sport: the 6th International Conference on Concussion in Sport– Amsterdam, October 2022

Jon S Patricios [1], Kathryn J Schneider [2], Jiri Dvorak [3], Osman Hassan Ahmed [4,5], Cheri Blauwet [6,7], Robert C Cantu,[8,9] Gavin A Davis [10,11], Ruben J Echemendia [12,13], Michael Makdissi,[14,15] Michael McNamee,[16,17] Steven Broglio [18], Carolyn A Emery [2], Nina Feddermann-Demont,[19,20] Gordon Ward Fuller [21], Christopher C Giza,[22,23] Kevin M Guskiewicz,[24] Brian Hainline [25], Grant L Iverson [26,27], Jeffrey S Kutcher,[28] John J Leddy [29], David Maddocks,[30] Geoff Manley [31], Michael McCrea [32], Laura K Purcell,[33] Margot Putukian [34], Haruhiko Sato [35], Markku P Tuominen,[36] Michael Turner [37,38], Keith Owen Yeates [39], Stanley A Herring,[40,41] Willem Meeuwisse[42]

Br J Sports Med 2023;**57**:695–711. doi:10.1136/bjsports-2023-106898

TWIN CITIES ORTHOPEDICS

WHAT'S NEW?

SCAT6™
Sport Concussion Assessment Tool
For Adolescents (13 years +) & Adults

SCOAT6™
Sport Concussion Office Assessment Tool
For Adults & Adolescents (13 years +)

REST AND EXERCISE

CONCUSSION EVALUATION PROCESS

SCAT6™
Sport Concussion Assessment Tool
For Adolescents (13 years +) & Adults

SCOAT6™
Sport Concussion Office Assessment Tool
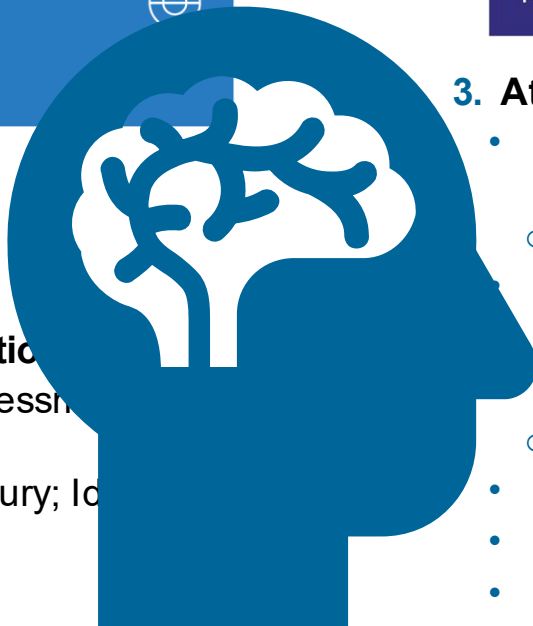For Adults & Adolescents (13 years +)

1. **On-Field Evaluation**
   - Evaluate for Red Flags
   - Initial Screening

2. **Off-Field/Sideline Evaluation**
   - Sport Concussion Assessment Tool (SCAT6)
     - Valid up to 7d s/p injury; Id
   - Symptom Evaluation
   - Cognitive Screening
   - Balance & Coordination

3. **Athletic Training Room/Office Evaluation**
   - Sport Concussion Office Assessment Tool (SCOAT6)
     - Used days to weeks s/p injury
   - Detailed PMH/FMH
   - Cognitive Testing
   - Physical Examination
     - Orthostatic Vitals | C-spine | Neuro Exam
   - Balance & Coordination
   - Modified VOMS
   - Mental Health Screening Tools
     - GAD-7 | PHQ-2 | Sleep Screen

TWIN CITIES ORTHOPEDICS

IMPLEMENTING THE SCAT6

ON-FIELD / IMMEDIATE EVALUATION

RED FLAGS

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

TWIN CITIES ORTHOPEDICS

OBSERVABLE SIGNS

RED FLAGS

- Seizure or convulsion
- Loss of Consciousness
- Vomiting

Step 1: 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

GLASGOW COMA SCALE

Step 2: Glasgow Coma Scale

Typically, GCS is assessed once. Additional scoring columns are provided for monitoring over time, if needed.

Time of Assessment:

Date of Assessment:

Best Eye Response (E)			
No eye opening	1	1	1
Eye opening 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 (V)			
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
Localized to pain	5	5	5
Obeys commands	6	6	6

Glasgow Coma Score (E + V + M)			

RED FLAGS

- GCS <15
- Deteriorating conscious state

CERVICAL SPINE ASSESSMENT

RED FLAGS

- Neck pain or tenderness

- Weakness or tingling/burning in more than 1 arm or in the legs

- Visible deformity of the skull

**Step 3: 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

RED FLAGS

- Double Vision
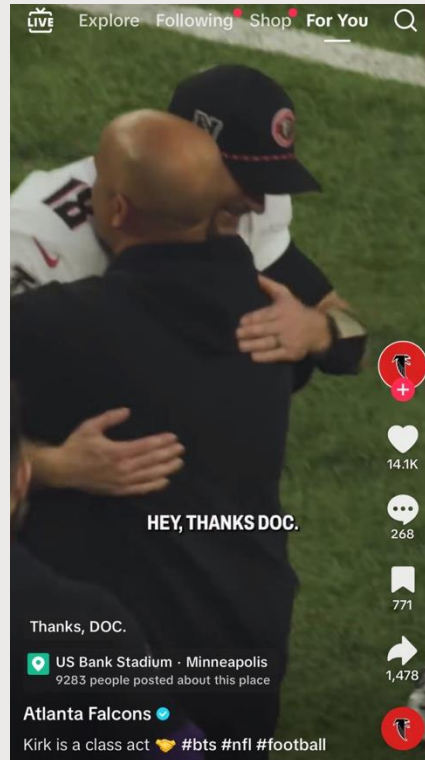
Step 4: Coordination & Ocular/Motor Screen

Coordination: Is finger-to-nose normal for both hands with eyes open and closed?	Y N
Ocular/Motor: Without moving their head or neck, can the patient look side-to-side and up-and-down without double vision?	Y N
Are observed extraocular eye movements normal? If not, describe:	Y N

MEMORY ASSESSMENT MADDOCKS QUESTIONS

RED FLAGS

- Increasing restless, agitated or combative

- Severe or increasing headache

Step 5: Memory Assessment Maddocks Questions[1]

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)

	0	1
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

Note: Appropriate sport-specific questions may be substituted

TWIN CITIES ORTHOPEDICS

DECISION TIME

Activate Emergency
Action Plan?
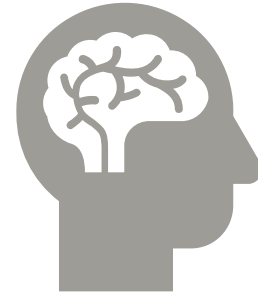
Continue with
Concussion Evaluation?

OFF-FIELD / SIDELINE EVALUATION

ATHLETE BACKGROUND

Useful during follow-up exam in ATR/Clinic

Step 1: Athlete Background

Has the athlete ever been:

Hospitalised for head injury? (If yes, describe below)	Y N	Diagnosed with attention deficit hyperactivity disorder (ADHD)?	Y N
Diagnosed/treated for headache disorder or migraine?	Y N	Diagnosed with depression, anxiety, or other psychological disorder?	Y N
Diagnosed with a learning disability/dyslexia?	Y N		

Notes:

Current medications? If yes, please list:

SYMPTOM EVALUATION

- Completed by Athlete or AT?
- KISS | Symptom + Exposure=DQ

TABLE 2-1 Concussion Diagnosis by Degree of Certainty

Classification	Definition	Management
Possible	Concussion is not the most likely cause of the clinical presentation. Other possible explanations are identified, such as migraine, dehydration, or viral illness. The presumed traumatic insult was not witnessed or is difficult to describe.	Situational (clinician may decide to treat as concussed or not, depending on the specific clinical situation)
Probable	Concussion is the most likely cause of the clinical presentation. While other possible explanations exist, they are deemed less likely. The traumatic insult was clearly defined by witnesses or is identifiable on video.	As concussed
Definite	Concussion is the only explanation for the clinical presentation.	As concussed

Step 2: Symptom Evaluation

Baseline: ☐ Suspected/Post-injury: ☐ Time elapsed since suspected injury: _____ mins/hours/days

The athlete will complete the symptom scale (below) after you provide instructions. Please note that the instructions are different for baseline versus suspected/post-injury evaluations.

Baseline: Say *"Please rate your symptoms below based on how you typically feel with "1" representing a very mild symptom and "6" representing a severe symptom."*

Suspected/Post-injury: Say *"Please rate your symptoms below based on how you feel now with "1" representing a very mild symptom and "6" representing a severe symptom."*

PLEASE HAND THE FORM TO THE ATHLETE

Symptom	Rating
Headaches	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

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?

If not 100%, why?

PLEASE HAND THE FORM BACK TO THE EXAMINER

Once the athlete has completed answering all symptom items, it may be useful for the clinician to revisit items that were endorsed positively to gather more detail about each symptom.

Total number of symptoms: _____ of 22   Symptom severity score: _____ of 132

COGNITIVE SCREENING

ORIENTATION

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
Orientation Score		of 5

COGNITIVE SCREENING IMMEDIATE MEMORY

- **BIG CHANGE!**
- What is "normal"?
  - ✓ 20/30 correct
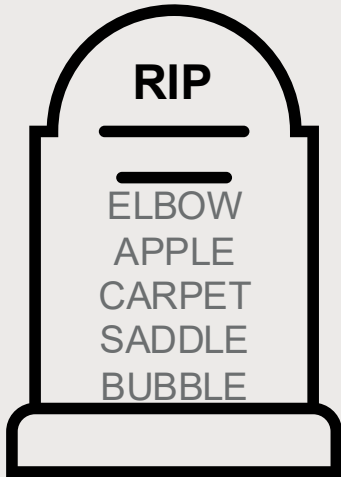
RIP

ELBOW
APPLE
CARPET
SADDLE
BUBBLE

Immediate Memory

All 3 trials must be administered irrespective of the number correct on Trial 1. Administer at the rate of one word per second.

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."*

Trials 2 and 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 before in a previous trial."*

Word list used: A ☐   B ☐   C ☐

List A	Trial 1		Trial 2		Trial 3		List B	List C
							Alternate Lists	
Jacket	0	1	0	1	0	1	Finger	Baby
Arrow	0	1	0	1	0	1	Penny	Monkey
Pepper	0	1	0	1	0	1	Blanket	Perfume
Cotton	0	1	0	1	0	1	Lemon	Sunset
Movie	0	1	0	1	0	1	Insect	Iron
Dollar	0	1	0	1	0	1	Candle	Elbow
Honey	0	1	0	1	0	1	Paper	Apple
Mirror	0	1	0	1	0	1	Sugar	Carpet
Saddle	0	1	0	1	0	1	Sandwich	Saddle
Anchor	0	1	0	1	0	1	Wagon	Bubble
Trial Total								

Immediate Memory Score	of 30	Time Last Trial Completed:	

COGNITIVE SCREENING CONCENTRATION

DIGITS BACKWARDS

Concentration

Digits Backward:

Administer at the rate of one digit per second reading DOWN the selected column. If a string is completed correctly, move on to the string with next higher number of digits; if the string is completed incorrectly, use the alternate string with the same number of digits; if this is failed again, end the test.

Say *"I'm 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)"*

Digit list used: A ☐   B ☐   C ☐

List A	List B	List C				
4-9-3	5-2-6	1-4-2	Y	N		
6-2-9	4-1-5	6-5-8	Y	N	0	1
3-8-1-4	1-7-9-5	6-8-3-1	Y	N		
3-2-7-9	4-9-6-8	3-4-8-1	Y	N	0	1
6-2-9-7-1	4-8-5-2-7	4-9-1-5-3	Y	N		
1-5-2-8-6	6-1-8-4-3	6-8-2-5-1	Y	N	0	1
7-1-8-4-6-2	8-3-1-9-6-4	3-7-6-5-1-9	Y	N		
5-3-9-1-4-8	7-2-4-8-5-6	9-2-6-5-1-4	Y	N	0	1
Digits Score						of 4

COGNITIVE SCREENING CONCENTRATION

MONTHS IN REVERSE ORDER

- Small change
- Timed component=complete within 30s

Months in Reverse Order:

Say *"Now tell me the months of the year in reverse order as QUICKLY and as accurately as possible. Start with the last month and go backward. So, you'll say December, November... go ahead"*

Start stopwatch and CIRCLE each correct response:

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

Time Taken to Complete (secs):   **Number of Errors:**

1 point if no errors and completion under 30 seconds

Months Score: of 1

Concentration Score (Digits + Months)   of 5

COORDINATION AND BALANCE

Modified BESS – OPTIONAL

Modified Balance Error Scoring System (mBESS)[3] testing

(see detailed administration instructions)

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

Testing Surface (hard floor, field, etc.):

Footwear (shoes, barefoot, braces, tape etc.):

Balance testing – types of errors

1. Hands lifted off iliac crest
2. Opening eyes
3. Step, stumble, or fall
4. Moving hip into > 30 degrees abduction
5. Lifting forefoot or heel
6. Remaining out of test position > 5 sec

On Foam (Optional)

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

COORDINATION AND BALANCE

TIMED TANDEM GAIT

- Previously Option, now Included
- Pass/Fail? (SCAT5)
- What is "normal"?
  - ✓ Under 20s
  - ✓ RCI=5.3s

Timed Tandem Gait

Place a 3-metre-long line on the floor/firm surface with athletic tape. The task should be timed. Please complete all 3 trials.

Say *"Please walk heel-to-toe quickly to the end of the tape, turn around and come back as fast as you can without separating your feet or stepping off the line."*

Single Task:

Time to Complete Tandem Gait Walking (seconds)				
Trial 1	Trial 2	Trial 3	Average 3 Trials	Fastest Trial

TWIN CITIES
ORTHOPEDICS

COORDINATION AND BALANCE – OPTIONAL

DUAL TASK GAIT

- Normative Data
  - ✓ Time to complete=under 26s
  - ✓ Total answered=16
  - ✓ Total correct=12
  - ✓ Percent correct=85%

Dual Task Gait (Optional. Timed Tandem Gait must be completed first)

Place a 3-metre-long line on the floor/firm surface with athletic tape. The task should be timed.

Say *"Now, while you are walking heel-to-toe, I will ask you to count backwards out loud by 7s. For example, if we started at 100, you would say 100, 93, 86, 79. Let's practise counting. Starting with 93, count backward by sevens until I say "stop"."* Note that this practice only involves counting backwards.

Dual Task Practice: Circle correct responses; record number of subtraction counting errors.

Task									Errors	Time
Practice	93	86	79	72	65	58	51	44		

Say *"Good. Now I will ask you to walk heel-to-toe and count backwards out loud at the same time. Are you ready? The number to start with is 88. Go!"*

Dual Task Cognitive Performance: Circle correct responses; record number of subtraction counting errors.

Task														Errors	Time (circle fastest)
Trial 1	88	81	74	67	60	53	46	39	32	25	18	11	4		
Trial 2	90	83	76	69	62	55	48	41	34	27	20	13	6		
Trial 3	98	91	84	77	70	63	56	49	42	35	28	21	14		

Alternate double number starting integers may be used and recorded below.

Starting Integer: _____   Errors: _____   Time: _____

DELAYED RECALL

What is "normal"?

✓ 7/10 correct

Step 5: Delayed Recall

The Delayed Recall should be performed after **at least 5 minutes** have elapsed since the end of the Immediate Memory section:
Score 1 point for each correct response.

Say *"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:

Word list used: A ☐   B ☐   C ☐

List A	Score		Alternate Lists	
			List B	List C
Jacket	0	1	Finger	Baby
Arrow	0	1	Penny	Monkey
Pepper	0	1	Blanket	Perfume
Cotton	0	1	Lemon	Sunset
Movie	0	1	Insect	Iron
Dollar	0	1	Candle	Elbow
Honey	0	1	Paper	Apple
Mirror	0	1	Sugar	Carpet
Saddle	0	1	Sandwich	Saddle
Anchor	0	1	Wagon	Bubble
Delayed Recall Score	of 10			

COGNITIVE SCORING

Total Cognitive Score

Orientation:	**5**	of 5
Immediate Memory:	**20**	of 30
Concentration:	**3**	of 5
Delayed Recall:	**7**	of 10
Total:	**35**	of 50

Step 6: Decision

Domain	Date:	Date:	Date:
Neurological Exam (Acute Injury evaluation only)	Normal/Abnormal	Normal/Abnormal	Normal/Abnormal
Symptom number (of 22)			
Symptom Severity (of 132)			
Orientation (of 5)			
Immediate Memory (of 30)			
Concentration (of 5)			
Delayed Recall (of 10)			
Cognitive Total Score (of 50)			
mBESS Total Errors (of 30)			
Tandem Gait fastest time			
Dual Task fastest time			

Disposition

Concussion diagnosed?

Yes ☐   No ☐   Deferred ☐

DECISION TIME

- CONCUSSION DIAGNOSIS

- RETURN TO SPORT

SCAT6 TAKE HOME POINTS

MEANINGFUL CHANGES

- 10-WORD MEMORY VS 5 WORD MEMORY
- TIMED MONTHS IN REVERSE – WITHIN 30S
- TIMED TANDEM GATE

OPTIONAL CHANGES

- Modified BESS on Foam
- Dual Task Gait
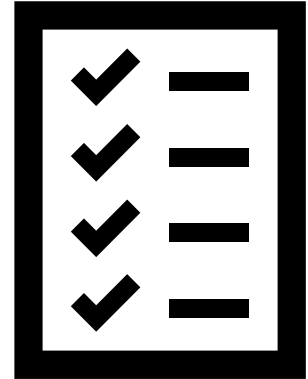
SPORT CONCUSSION OFFICE ASSESSMENT TOOL (SCOAT6)

- Developed for use in days to weeks following concussion

- Provides Standardized Assessment

- Multimodal tool to be used in serial evaluation of athletes s/p concussion

- Color Coded:
  - **BLACK**=Completed only on initial use
  - **GREEN**=Recommended components
  - **ORANGE**=Optional components

- Insight into possible symptom drivers

- Sections can be used as needed/indicated

CURRENT INJURY (HPI)

- Continued participation=increased recovery time
- Remote onset of symptoms – other causes?

Current Injury

Removal From Play: Immediate ☐   Continued to play for _____ mins ☐

Walked off ☐   Assisted off ☐   Stretchered off ☐

Date of Injury:

Description - include mechanism of injury, presentation, management since the time of injury and trajectory of care since injury:

Date Symptoms First Appeared: **Date Symptoms First Reported:**

History of Head Injuries

Date/Year	Description - include mechanism of injury, presentation, management since the time of injury and trajectory of care since injury	Management - including time off work, school or sport

CONCUSSION HISTORY

Injury Frequency

Injury Proximity

Previous Recovery Time

Still no "Magic Number" for DQ

TWIN CITIES ORTHOPEDICS

PAST MEDICAL HISTORY

More likely to be an issue after Concussion

History of Any Neurological, Psychological, Psychiatric or Learning Disorders

Diagnosis	Year Diagnosed	Management Including Medication
☐ Migraine		
☐ Chronic headache		
☐ Depression		
☐ Anxiety		
☐ Syncope		
☐ Epilepsy/seizures		
☐ Attention deficit hyper-activity disorder (ADHD)		
☐ Learning disorder/ dyslexia		
☐ Other_____		

MEDICATIONS | ROUTINE – ROUTINE – ROUTINE

List All Current Medications - including over-the-counter, naturopathic and supplements

Item	Dose	Frequency	Reason Taken

TWIN CITIES ORTHOPEDICS

FAMILY MEDICAL HISTORY

Family History of Any Diagnosed Neurological, Psychological, Psychiatric, Cognitive or Developmental Disorders		
Family Member	**Diagnosis**	**Management Including Medication**
	☐ Depression	
	☐ Anxiety	
	☐ Attention deficit hyper-activity disorder (ADHD)	
	☐ Learning disorder/ dyslexia	
	☐ Migraine	
	☐ Other _____	

Identity possible Risk Factors

- Younger Adolescents

SYMPTOM EVALUATION

SCAT6 Symptom Score
- Valid throughout recovery

SCOAT6 Additions
- Abnormal Heart Rate
- Excessive Sweating
- Other

Symptom Evaluation

Please rate your symptoms below based on how you feel now with "1" representing a very mild symptom and "6" representing a severe symptom.

0 None	1 Mild	2	3 Moderate	4	5 Severe	6

Symptom	Pre-injury	Day injured (date)	Consult 1	Consult 2	Consult 3
	Rating	Rating	Rating	Rating	Rating
Headaches					
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"					
Difficulty concentrating					
Difficulty remembering					
Fatigue or low energy					
Confusion					
Drowsiness					
More emotional					
Irritability					
Sadness					
Nervous or anxious					
Sleep disturbance					
Abnormal heart rate					
Excessive sweating					
Other _____					

VERBAL COGNITIVE TESTS

IMMEDIATE MEMORY

Immediate Memory

All 3 trials must be administered irrespective of the number correct on Trial 1. Administer at the rate of one word per second in a monotone voice.

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."*

Trials 2 and 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 before in a previous trial."*

Word list used: A ☐   B ☐   C ☐

List A	Trial 1	Trial 2	Trial 3				Alternate Lists	
							List B	List C
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Pepper	0	1	0	1	0	1	Blanket	Perfume
Cotton	0	1	0	1	0	1	Lemon	Sunset
Movie	0	1	0	1	0	1	Insect	Iron
Dollar	0	1	0	1	0	1	Candle	Elbow
Honey	0	1	0	1	0	1	Paper	Apple
Mirror	0	1	0	1	0	1	Sugar	Carpet
Saddle	0	1	0	1	0	1	Sandwich	Saddle
Anchor	0	1	0	1	0	1	Wagon	Bubble
Trial Total								

Immediate Memory Total _____ of 30

Time last trial completed:

DIGITS BACKWARDS

Digits Backwards

Administer at the rate of one digit per second in a monotone voice reading DOWN the selected column. If a string is completed correctly, move on to the string with next higher number of digits; if the string is completed incorrectly, use the alternate string with the same number of digits; if this is failed again, end the test.

Say *"I'm 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"*

Digit list used: A ☐   B ☐   C ☐

List A	List B	List C				
4-9-3	5-2-6	1-4-2	Y	N	0	1
6-2-9	4-1-5	6-5-8	Y	N		
3-8-1-4	1-7-9-5	6-8-3-1	Y	N	0	1
3-2-7-9	4-9-6-8	3-4-8-1	Y	N		
6-2-9-7-1	4-8-5-2-7	4-9-1-5-3	Y	N	0	1
1-5-2-8-6	6-1-8-4-3	6-8-2-5-1	Y	N		
7-1-8-4-6-2	8-3-1-9-6-4	3-7-6-5-1-9	Y	N	0	1
5-3-9-1-4-8	7-2-4-8-5-6	9-2-6-5-1-4	Y	N		
		Digits score				of 4

MONTHS IN REVERSE

Months in Reverse Order

Say *"Now tell me the months of the year in reverse order as QUICKLY and as accurately as possible. Start with the last month and go backward. So, you'll say December, November... go ahead"*

Start stopwatch and CIRCLE each correct response:

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

Time Taken to Complete (secs): _____   (N <30 sec)   Number of Errors: _____

VERBAL COGNITIVE TEST – OPTIONAL

Verbal Cognitive Tests: Alternate 15-word lists

Alternate 15-word lists may be accessed by scanning or clicking the QR code.

Record the total below.

Total _____ of 45

TWIN CITIES
ORTHOPEDICS

ORTHOSTATIC VITALS

Orthostatic Vital Signs

The first blood pressure and heart rate measurements are taken after the patient lies supine on the examination table for at least 2 minutes. The patient is then asked to stand up without support and with both feet firmly on the ground and the second measurements are taken after standing for 1 minute. Ask the patient if they experience any dizziness or light-headedness upon standing (initial orthostatic intolerance) or by one minute (orthostatic intolerance).

Orthostatic Vital Signs	Supine	Standing (after 1 minute)
Blood Pressure (mmHg)		
Heart Rate (bpm)		
Symptoms[1] • Dizziness or light-headedness • Fainting • Blurred or fading vision • Nausea • Fatigue • Lack of concentration	No ☐ Yes ☐ If yes: Description	No ☐ Yes ☐ If yes: Description
Results	☐ Normal ☐ Abnormal	

Test results are deemed clinically significant if they include at least one of the following AND symptoms:
(1) systolic BP drop of ≥ 20mmHg or (2) diastolic BP drop of ≥ 10mmHg (3) HR decreases (4) HR increases by > 30bpm

- Assessment for Autonomic Dysfunction

CERVICAL SPINE ASSESSMENT

Does <u>not</u> exclude possible cervicogenic symptoms

Neurological Examination

Cranial Nerves

Normal ☐   Abnormal ☐   Not tested ☐

Notes:

Other Neurological Findings

Limb Tone:	Normal ☐	Abnormal ☐	Not tested ☐
Strength:	Normal ☐	Abnormal ☐	Not tested ☐
Deep Tendon Reflexes:	Normal ☐	Abnormal ☐	Not tested ☐
Sensation:	Normal ☐	Abnormal ☐	Not tested ☐
Cerebellar Function:	Normal ☐	Abnormal ☐	Not tested ☐

Comments:

NEURO EXAM

TWIN CITIES ORTHOPEDICS

BALANCE & COORDINATION

Modified BESS On Foam=**OPTIONAL**

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

Timed Tandem Gait

Place a 3-metre-long line on the floor/firm surface with athletic tape.

Say *"Please walk heel-to-toe quickly to the end of the tape, turn around and come back as fast as you can without separating your feet or stepping off the line."*

Time to Complete Tandem Gait Walking (seconds)				
Trial 1	Trial 2	Trial 3	Average 3 Trials	Fastest Trial

Abnormal/failed to complete ☐   Unstable/sway ☐   Fall/over-step ☐   Dizzy/nauseous ☐

COORDINATION - OPTIONAL

COMPLEX TANDEM GAIT

Eyes Open & Closed

Pass/Fail

Not timed

Complex Tandem Gait

Forward

Say *"Please walk heel-to-toe quickly five steps forward, then continue forward with eyes closed for five steps"* 1 point for each step off the line, 1 point for truncal sway or holding onto an object for support.

Forward Eyes Open	Points:	
Forward Eyes Closed	Points:	
Forward Total Points:		

Backward

Say *"Please walk heel-to-toe again, backwards five steps eyes open, then continue backwards five steps with eyes closed."* 1 point for each step off the line, 1 point for truncal sway or holding onto an object for support.

Backward Eyes Open	Points:	
Backward Eyes Closed	Points:	
Backward Total Points:		
Total Points (Forward + Backward):		

DUAL TASK GAIT

Additional Cognitive Tasks Available

- Words – spelled backwards
- Serial 7s
- Months Backwards

Dual Task Gait

Say *"Now, while you are walking heel-to-toe, I will ask you to recite the following words in reverse order / count backwards out loud by 7s (for instance starting at 100, then 93, 86 etc,) / recite the months of the year in reverse order"*

(select one cognitive task). Allow for a verbal practice attempt of the cognitive task selected.

Cognitive Tasks								
Trial 1 (Words - spell backwards)	VISIT	ALERT	FENCE	BRAVE	MOUSE	DANCE	CRAWL	LEARN
OR Trial 2 (Subtract serial 7s)	95	88	81	74	67	60	53	46
OR Trial 3 (Months backwards)	December	November	October	September	August	July	June	May	April	March	February	January

Before attempting the dual task: *"Good. Now I will ask you to walk heel-to-toe calling the answers out loud at the same time. Are you ready?"*

Number of Trials Attempted:		Number of Correct Trials:		Average Time (s):	
Cognitive Accuracy Score (Number Correct / Number Attempted):					

TWIN CITIES ORTHOPEDICS

MODIFIED VOMS

Does **NOT** include:

- Saccades – Vertical
- Near Point Convergence
- VOR – Vertical

Modified Vestibular/Ocular-Motor Screening (mVOMS) for Concussion

For detailed instructions please see the Supplement.

mVOMS	Not Tested	Headache	Dizziness	Nausea	Fogginess	Comments
Baseline symptoms	N/A					
Smooth pursuits (2 horizontal and 2 vertical, 2 seconds to go full distance right-left and back; up-down and back)						
Saccades – Horizontal (10 times each direction)						
VOR – Horizontal (10 repetitions) (metronome set at 180 beats per minute – change direction at each beep, wait 10 secs to ask symptoms)						
VMS (x 5, 80° rotation side to side) (at 50 bpm, change direction each beep, wait 10 secs to ask symptoms)						

MENTAL HEALTH SCREENING TOOLS

GAD-7

Anxiety Screen

Not Done ☐

Assign scores of 0, 1, 2, and 3 to the response categories, respectively, of **"not at all," "several days," "more than half the days,"** and **"nearly every day."**

Over the last 2 weeks, how often have you been bothered by any of the following problems?	Not at all	Several days	More than half the days	Nearly every day
1. Feeling nervous, anxious, or on edge	0	1	2	3
2. Not being able to stop or control worrying	0	1	2	3
3. Worrying too much about different things	0	1	2	3
4. Trouble relaxing	0	1	2	3
5. Being so restless that it's hard to sit still	0	1	2	3
6. Becoming easily annoyed or irritable	0	1	2	3
7. Feeling afraid as if something awful might happen	0	1	2	3

Anxiety Screen Score: ☐

0–4: minimal anxiety 5–9: mild anxiety
10–14: moderate anxiety 15–21: severe anxiety

PHQ-2

Depression Screen

Not Done ☐

The purpose is to screen for depression in a "first-step" approach. Patients who screen positive should be further evaluated with the PHQ-9 to determine whether they meet criteria for a depressive disorder.

Over the last 2 weeks, how often have you been bothered by any of the following problems?	Not at all	Several days	More than half the days	Nearly every day
1. Little interest or pleasure in doing things	0	1	2	3
2. Feeling down, depressed or hopeless	0	1	2	3

Depression Screen Score: ☐ (Ranges from 0-6, 3 being the cutpoint to screen for depression)

TWIN CITIES ORTHOPEDICS

SLEEP SCREENING TOOL

Sleep Screen

Not Done ☐

1. During the past week how many hours of actual sleep did you get at night? (This may be different than the number of hours you spent in bed.)	
5 to 6 hours	4
6 to 7 hours	3
7 to 8 hours	2
8 to 9 hours	1
More than 9 hours	0

2. How satisfied/dissatisfied were you with the quality of your sleep?	
Very dissatisfied	4
Somewhat dissatisfied	3
Somewhat satisfied	2
Satisfied	1
Very satisfied	0

3. During the recent past, how long has it usually taken you to fall asleep each night?	
Longer than 60 minutes	3
31-60 minutes	2
16-30 minutes	1
15 minutes or less	0

4. How often do you have trouble staying asleep?	
Five to seven times a week	3
Three of four times a week	2
Once or twice a week	1
Never	0

5. During the recent past, how often have you taken medicine to help you sleep? (prescribed or over-the-counter)	
Five to seven times a week	3
Three of four times a week	2
Once or twice a week	1
Never	0

Sleep Screen Score: ☐

A higher sleep disorder score (SDS) indicates a greater likelihood of a clinical sleep disorder:
0-4 (Normal)
5-7 (Mild)
8-10 (Moderate)
11-17 (Severe)

DELAYED RECALL

Delayed Word Recall

Minimum of 5 minutes after immediate recall

Say *"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."*

Word list used: A ☐   B ☐   C ☐

List A	Score		List B	List C
Jacket	0	1	Finger	Baby
Arrow	0	1	Penny	Monkey
Pepper	0	1	Blanket	Perfume
Cotton	0	1	Lemon	Sunset
Movie	0	1	Insect	Iron
Dollar	0	1	Candle	Elbow
Honey	0	1	Paper	Apple
Mirror	0	1	Sugar	Carpet
Saddle	0	1	Sandwich	Saddle
Anchor	0	1	Wagon	Bubble

(Alternate Lists header spans List B and List C columns)

Score: ☐ of 10   Record Actual Time (mins) Since Completing Immediate Recall: ☐

ADDITONAL INFORMATION INCLUDED

- COMPUTERIZED COGNITIVE TEST RESULTS DOCUMENTATION
- GRADED EXERCISE TEST
- MANAGEMENT AND FOLLOW-UP PLAN
  - Including appropriate Referral
- Return-to-Learn Strategy Information
- Return-to-Sport Strategy Information
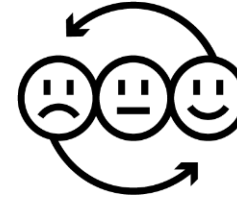
SCOAT6 TAKE HOME POINTS

- HELPFUL IN IDENTIFYING CONCUSSION PHEYNOTYPE

- CAN CHOOSE WHICH SECTION TO UTILIZE

- REPRESENTS A MULTI-MODAL APPROACH WHICH IS BEST PRACTICE

- MAY BE USED IN CONJUNCTION WITH OTHER ASSESSMENT TOOLS

- PROVIDES STANDARDIZATION THROUGHOUT RECOVERY
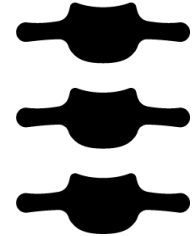
Autonomic (Central) Dysfunction

MIGRAINE MOOD COGNITIVE
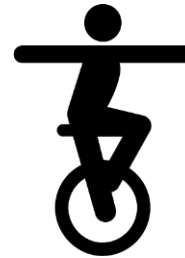
VESTIBULAR OCULAR CERVICAL

Peripheral Dysfunction

TWIN CITIES ORTHOPEDICS

REST AND EXERCISE

THE ROLE OF REST

- Strick Rest is not recommended
- Limit Screen Time 0-48h s/p injury
- Symptom-limited activity (ADLs; walking) okay during 0-48h s/p injury
- Sub-symptom threshold exercise
  - Decreases Symptoms
  - Decreases Recovery Time
  - Decreases risk for prolonged recovery (>4w)

EXERTIONAL TESTING BCTT/BCBT

- Modified Cardiac Testing

- Performed on either a Treadmill (BCTT) or Exercise Bike (BCBT)

- Increasing intensity (Incline – Tread or Resistant – Bike) while monitoring HR until:
  - Symptoms increase by >2 points=**FAIL**
  - RPE >17 & reach ≥80% age-predicted maxHR=**PASS**
  - Reach ≥90% age-predicted maxHR=**PASS**
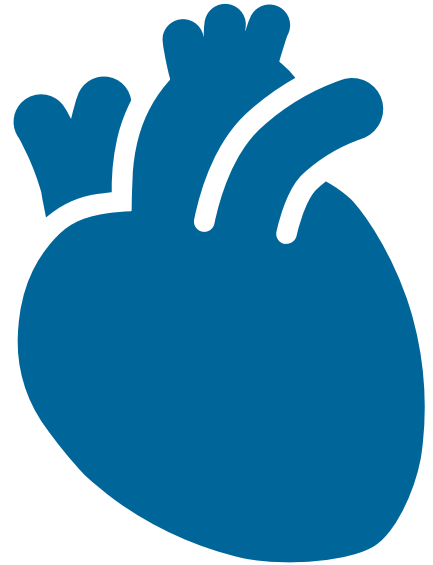
EXERCISE PRESCRIPTION WITH EXERTIONAL TESTING

ACUTE SPORTS CONCUSSION

- Begin program at 80% Threshold HR

- Discontinue if symptoms increased by 2 or more points (on VAS) from pre-exercise level, or

- 20 minutes of exercise completed with out symptom exacerbation

- BCTT performed every 3d to weekly to determine new target HR

- Exercise performed until asymptomatic

POST-CONCUSSION SYNDROME (SYMPTOMS>4WKS)

- 20 minute/day of aerobic exercise of 80% threshold HR for 2 weeks

- If tolerated, increase target HR
  - 5 bpm for non-athletes
  - 10 bpm for athletes

- Repeat every 2 weeks until 80-90% of age-predicted max HR for 20 minutes w/o symptom exacerbation

- Begin graduated RTS Strategy
  - May complete Stages 1-3 to symptom tolerance
  - If symptoms return, repeat BCTT

TWIN CITIES ORTHOPEDICS

EXERCISE PRESCRIPTION WITHOUT EXERTIONAL TESTING

SYMPTOM ASSESSMENT

- Conduct Visual Analog Scale (VAS) for overall concussion symptom burden

"On a scale of "0-10" with 0 being normal with no symptoms and 10 being the worst you think you could possibly feel, what number would you rank yourself?"
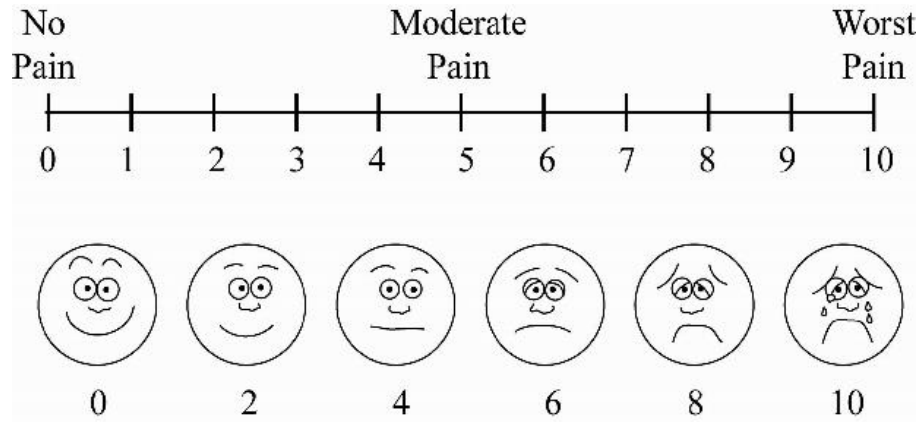
VAS>7 symptom-limited activity only

HEART RATE CALCULATION

Calculate age-predicted maximum Heart Rate (max HR)

220-Age of Athlete=max HR

Complete 20 minutes of exercise or until VAS increase by >2 points

Begin with Light Aerobic Exercise

If symptoms persist for >1 hour, regress to previous step

Progress to next step when there is no increase of symptoms

EXERCISE PROGRESSION

Light Aerobic Exercise
- Up to 55% age-predicted max HR
- Walking, stationary bike
  - Slow to medium pace
- Light resistance training

Moderate Aerobic Exercise
- Increase up to 70% max HR
- Walking, stationary bike
- Light resistance training

Individual Sport Specific Exercise
- Running
- Change of direction/agility
- Sport-specific individual drills
- Moderate to heavy resistance training

HOW DOES THIS EFFECT RETURN TO PLAY?

- CISG – Provided updated RTS Progress
  - Allows for early exercise prescription

Table 1 Graduated return-to-sport (RTS) 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, eg, 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	

RTP: 5 day process after clinical recovery
No Team Activities until asymptotic x3 days

TWIN CITIES ORTHOPEDICS

2022 CONSENSUS UPDATE FOR RETURN TO SPORT

Table 2 Return-to-sport (RTS) strategy—each step typically takes a minimum of 24 hours

Step	Exercise strategy	Activity at each step	Goal
1	Symptom-limited activity	Daily activities that do not exacerbate symptoms (eg, walking).	Gradual reintroduction of work/school
2	Aerobic exercise **2A—Light** (up to approximately 55% maxHR) **then** **2B—Moderate** (up to approximately 70% maxHR)	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 training involves any risk of inadvertent head impact, medical clearance should occur prior to Step 3	Sport-specific training away from the team environment (eg, 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 the 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 (eg, passing drills, multiplayer training) can integrate into a 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.	

*Mild and brief exacerbation of symptoms (ie, an increase of no more than 2 points on a 0–10 point scale for less than an hour when compared with the baseline value reported prior to physical activity). Athletes may begin Step 1 (ie, symptom-limited activity) within 24 hours of injury, with progression through each subsequent step typically taking a minimum of 24 hours. If more than mild exacerbation of symptoms (ie, more than 2 points on a 0–10 scale) occurs during Steps 1–3, the athlete should stop and attempt to exercise the next day. Athletes experiencing concussion-related symptoms during Steps 4–6 should return to Step 3 to establish full resolution of symptoms with exertion before engaging in at-risk activities. Written determination of readiness to RTS should be provided by an HCP before unrestricted RTS as directed by local laws and/or sporting regulations.

HCP, healthcare professional; maxHR, predicted maximal heart rate according to age (ie, 220-age).

TWIN CITIES ORTHOPEDICS

REST & EXERCISE TAKE HOME POINTS

Strict rest is no longer recommended.

Sub-symptom threshold exercise should begin between 2-14d s/p injury.
- Use age-predicted maxHR, or
- Determine 80% maxHR using exertional testing.

Patient may complete Steps 1-3 of RTP while symptomatic, but should not begin Step 4 until asymptomatic, have return to full academic participation, and have a normal exam.

Policy will continue to require 5-day Step-wise process once asymptomatic

THANK YOU!