Sports Related Concussion

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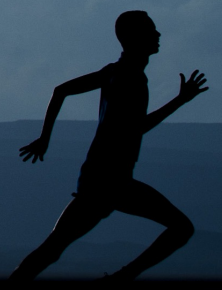

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SCENARIO

- 18 year old male was playing ultimate frisbee. While attempting to catch a pass, lays out, hits the side of his head on the grass. Gets up immediately to play. Finished the game but developed a slight headache towards the end of the game. No prior head injuries. Develops slight irritability and trouble focusing for midterm exams next several days.

RESPONSE

- How many people think he had a concussion?
- How many would send to the ER?
- How many would want a CT Scan?
- How many would schedule a follow up?
- What would be your next steps?

OUTLINE

1. Process and Definitions
2. Evaluation
3. Management
4. Modifying Factors
5. Special Populations
6. Other Issues
7. SCAT3

1. PROCESS

- 1st Vienna 2001, 2nd Prague 2004, 3rd Zurich 2008
- 4th meeting in Zurich 2012
  - NIH consensus development conference format
    - Pre-defined group of questions
    - Body of literature identified
    - Presentation by experts in open session day 1 and day 2
    - Discussion / debate closed session with consensus panel on day 3
    - Document drafted by authors and circulated to panel
    - Knowledge translation

ZURICH 2012 - QUESTIONS

1. What is the lowest threshold to make a diagnosis of concussion?
2. Are the existing tools/exam sensitive and reliable enough on the day of injury to make or exclude a diagnosis of concussion?
3. What is the best practice for evaluating an adult athlete on the "field of play" in 2012? 2015?
4. How can the SCAT2 be improved?: evidence for utility of components
5. What evidence exists for new strategies/technologies in the diagnosis of concussion and assessment of recovery?

ZURICH 2012 - QUESTIONS

6. Advances in the management of sport concussion: what is evidence for concussion therapies?
7. The difficult concussion patient - What is the best approach to investigation and management of persistent (>10 days) post concussive symptoms?
8. Revisiting Modifiers: how should the evaluation and management of acute concussion differ in specific groups?
9. What are the most effective risk reduction strategies in sport concussion?: from protective equipment to policy
10. What is the evidence for chronic concussion-related changes?; behavioral, pathological and clinical outcomes
11. From Consensus to Action- How do we optimize Knowledge transfer, education and ability to influence policy?

OUTPUTS:

Co-publication multiple journals 2013 including:

- BJSM
  - with critical reviews
- CJSM
- J. Athletic Tr
- J. Clin Neurosci
- J. Sci & Med in Sport
- PM&R
- Scand J Sci Med Sport
- S. African J. of Sport Med
- J. Amer College of Surgeons

2. DEFINITIONS

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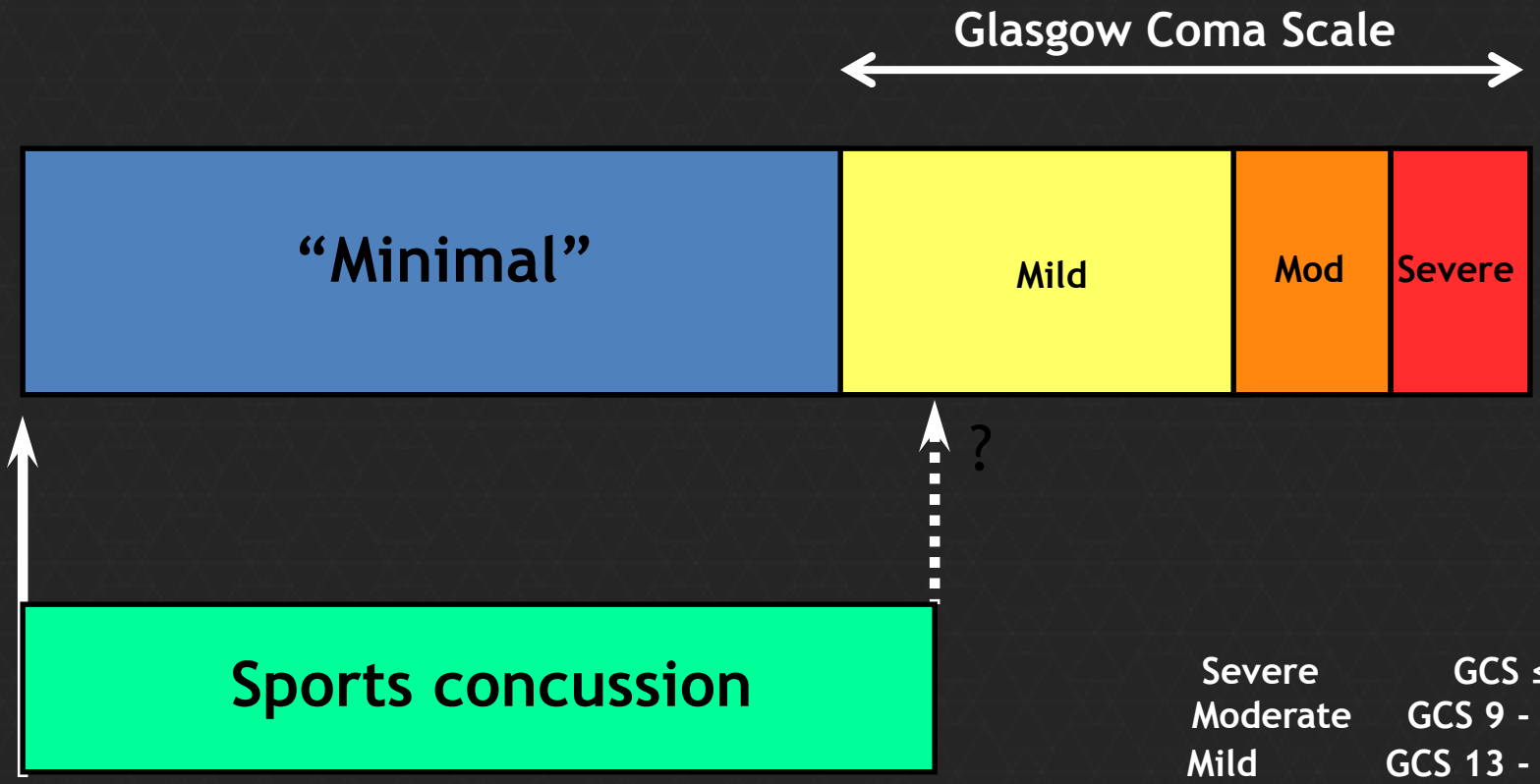
TRAUMATIC BRAIN INJURY



Severe	GCS ≤ 8
Moderate	GCS 9 - 12
Mild	GCS 13 - 15

Teasdale et al Lancet 1974; ii: 81-4

DEFINITION: SPORTS CONCUSSION

"Concussion is a brain injury and is defined as a complex pathophysiological process affecting the brain, induced by biomechanical forces. Several common features that incorporate clinical, pathologic and biomechanical injury constructs that may be utilized in defining the nature of a concussive head injury include…"

DEFINITION

1. *Concussion may be caused either by a direct blow to the head, face, neck or elsewhere on the body with an "impulsive" force transmitted to the head.*
2. *Concussion typically results in the rapid onset of short-lived impairment of neurologic function that resolves spontaneously. However in some cases symptoms and signs may evolve over a number of minutes to hours.*
3. *Concussion may result in neuropathological changes but the acute clinical symptoms largely reflect a functional disturbance rather than a structural injury and as such, no abnormality is seen on standard structural neuroimaging studies.*
4. *Concussion results in a graded set of clinical symptoms that may or may not involve loss of consciousness. Resolution of the clinical and cognitive symptoms typically follows a sequential course. However it is important to note that in some cases, post-concussive symptoms may be prolonged.*


3. EVALUATION
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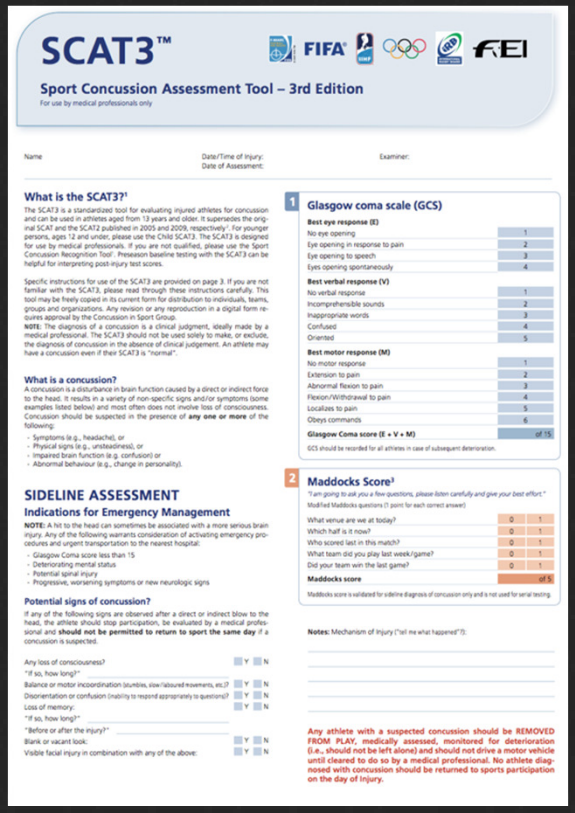
SIGNS AND SYMPTOMS

- Symptoms - somatic (e.g. headache), cognitive (e.g. feeling like in a fog) and/or emotional symptoms (e.g. lability)
- Physical signs (e.g. loss of consciousness, amnesia)
- Behavioural changes (e.g. irritability)
- Cognitive impairment (e.g. slowed reaction times)
- Sleep disturbance (e.g. drowsiness, insomnia)

ON-FIELD EVALUATION OF CONCUSSION

- The player should be evaluated by a physician or other licensed healthcare provider onsite using standard emergency management principles and particular attention should be given to excluding a cervical spine injury.
- The appropriate disposition of the player must be determined by the treating healthcare provider in a timely manner. If no healthcare provider is available the player should be safely removed from practice or play and urgent referral to a physician arranged.
- Once the first aid issues are addressed an assessment of the concussive injury should be made using the SCAT3 or other sideline assessment tools.
- The player should not be left alone following the injury and serial monitoring for deterioration is essential over the initial few hours following injury.
- A player with diagnosed concussion should not be allowed to return to play on the day of injury.

SCAT3



SCAT3™

Sport Concussion Assessment Tool – 3rd Edition

For use by medical professionals only

Name | Date/Time of injury: / Date of Assessment: | Examiner:

What is the SCAT3?[1]

The SCAT3 is a standardized tool for evaluating injured athletes for concussion and can be used in athletes aged from 13 years and older. It supersedes the original SCAT and the SCAT2 published in 2005 and 2009, respectively[2]. For younger persons, ages 12 and under, please use the Child SCAT3. The SCAT3 is designed for use by medical professionals. If you are not qualified, please use the Sport Concussion Recognition Tool[3]. Preseason baseline testing with the SCAT3 can be helpful for interpreting post-injury test scores.

Specific instructions for use of the SCAT3 are provided on page 3. If you are not familiar with the SCAT3, please read through these instructions carefully. This tool may be freely copied in its current form for distribution to individuals, teams, groups and organizations. Any revision or any reproduction in a digital form requires approval by the Concussion in Sport Group.

NOTE: The diagnosis of a concussion is a clinical judgment, ideally made by a medical professional. The SCAT3 should not be used solely to make, or exclude, the diagnosis of concussion in the absence of clinical judgement. An athlete may have a concussion even if their SCAT3 is "normal".

What is a concussion?

A concussion is a disturbance in brain function caused by a direct or indirect force to the head. It results in a variety of non-specific signs and/or symptoms (some examples listed below) and most often does not involve loss of consciousness. Concussion should be suspected in the presence of **any one or more** of the following:

- Symptoms (e.g., headache), or
- Physical signs (e.g., unsteadiness), or
- Impaired brain function (e.g. confusion) or
- Abnormal behaviour (e.g., change in personality).

SIDELINE ASSESSMENT

Indications for Emergency Management

NOTE: A hit to the head can sometimes be associated with a more serious brain injury. Any of the following warrants consideration of activating emergency procedures and urgent transportation to the nearest hospital:

- Glasgow Coma score less than 15
- Deteriorating mental status
- Potential spinal injury
- Progressive, worsening symptoms or new neurologic signs

Potential signs of concussion?

If any of the following signs are observed after a direct or indirect blow to the head, the athlete should stop participation, be evaluated by a medical professional and **should not be permitted to return to sport the same day** if a concussion is suspected.

Any loss of consciousness?	Y N
"If so, how long?"	
Balance or motor incoordination (stumbles, slow/laboured movements, etc)?	Y N
Disorientation or confusion (inability to respond appropriately to questions)?	Y N
Loss of memory:	Y N
"If so, how long?"	
"Before or after the injury?"	
Blank or vacant look:	Y N
Visible facial injury in combination with any of the above:	Y N

1 Glasgow coma scale (GCS)

Best eye response (E)	
No eye opening	1
Eye opening in response to pain	2
Eye opening to speech	3
Eyes opening spontaneously	4
Best verbal response (V)	
No verbal response	1
Incomprehensible sounds	2
Inappropriate words	3
Confused	4
Oriented	5
Best motor response (M)	
No motor response	1
Extension to pain	2
Abnormal flexion to pain	3
Flexion/Withdrawal to pain	4
Localizes to pain	5
Obeys commands	6
Glasgow Coma score (E + V + M)	of 15

GCS should be recorded for all athletes in case of subsequent deterioration.

2 Maddocks Score[3]

"I am going to ask you a few questions, please listen carefully and give your best effort."

Modified Maddocks questions (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		of 5

Maddocks score is validated for sideline diagnosis of concussion only and is not used for serial testing.

Notes: Mechanism of Injury ("tell me what happened"?):

Any athlete with a suspected concussion should be REMOVED FROM PLAY, medically assessed, monitored for deterioration (i.e., should not be left alone) and should not drive a motor vehicle until cleared to do so by a medical professional. No athlete diagnosed with concussion should be returned to sports participation on the day of injury.

BACKGROUND

Name: Date:
Examiner:
Sport/team/school: Date/time of injury:
Age: Gender: M F
Years of education completed:
Dominant hand: right left neither
How many concussions do you think you have had in the past?
When was the most recent concussion?
How long was your recovery from the most recent concussion?

Have you ever been hospitalized or had medical imaging done for a head injury?	Y N
Have you ever been diagnosed with headaches or migraines?	Y N
Do you have a learning disability, dyslexia, ADD/ADHD?	Y N
Have you ever been diagnosed with depression, anxiety or other psychiatric disorder?	Y N
Has anyone in your family ever been diagnosed with any of these problems?	Y N
Are you on any medications? If yes, please list:	Y N

SCAT3 to be done in resting state. Best done 10 or more minutes post exercise.

SYMPTOM EVALUATION

3 How do you feel?

"You should score yourself on the following symptoms, based on how you feel now".

	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
Trouble falling asleep	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

Total number of symptoms (Maximum possible 22)
Symptom severity score (Maximum possible 132)

Do the symptoms get worse with physical activity? Y N
Do the symptoms get worse with mental activity? Y N

self rated | self rated and clinician monitored | clinician interview | self rated with parent input

Overall rating: If you know the athlete well prior to the injury, how different is the athlete acting compared to his/her usual self?

Please circle one response:

no different | very different | unsure | N/A

Scoring on the SCAT3 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. Since signs and symptoms may evolve over time, it is important to consider repeat evaluation in the acute assessment of concussion.

COGNITIVE & PHYSICAL EVALUATION

4 Cognitive assessment

Standardized Assessment of Concussion (SAC)[1]

Orientation (1 point for each correct answer)

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

Immediate memory

List	Trial 1		Trial 2		Trial 3		Alternative word list		
elbow	0	1	0	1	0	1	candle	baby	finger
apple	0	1	0	1	0	1	paper	monkey	penny
carpet	0	1	0	1	0	1	sugar	perfume	blanket
saddle	0	1	0	1	0	1	sandwich	sunset	lemon
bubble	0	1	0	1	0	1	wagon	iron	insect
Total									

Immediate memory score total of 15

Concentration: Digits Backward

List	Trial 1		Alternative digit list	
4-9-3	0	1	6-2-9	1-5-2-6	4-1-5
3-8-1-4	0	1	3-2-7-9	1-7-9-5	4-9-6-8
6-2-9-7-1	0	1	1-5-2-8-6	3-8-5-2-7	6-1-8-4-3
7-1-8-4-6-2	0	1	5-3-9-1-4-8	8-3-1-9-6-4	7-2-4-8-5-6

Total of 4

Concentration: Month in Reverse Order (1 pt. for entire sequence correct)

Dec-Nov-Oct-Sept-Aug-Jul-Jun-May-Apr-Mar-Feb-Jan 0 1

Concentration score of 5

5 Neck Examination:

Range of motion | Tenderness | Upper and lower limb sensation & strength

Findings:

6 Balance examination

Do one or both of the following tests.

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

Modified Balance Error Scoring System (BESS) testing[1]

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

Testing surface (hard floor, field, etc.)

Condition

Double leg stance:	Errors
Single leg stance (non-dominant foot):	Errors
Tandem stance (non-dominant foot at back):	Errors

And / Or

Tandem gait[4,7]

Time (best of 4 trials): seconds

7 Coordination examination

Upper limb coordination

Which arm was tested: Left Right

Coordination score of 1

8 SAC Delayed Recall[4]

Delayed recall score of 5

NOTE: Developed by SCAT3 Subcommittee (Meeuwisse, McCrory, Dvorak, Echemendia, Guskiewicz Iverson, Johnston, McCrea, Putukian, Raftery, Schneider)

EVALUATION IN EMERGENCY ROOM OR OFFICE BY MEDICAL PERSONNEL

- Individual clinical decision
- A medical assessment including a comprehensive history and detailed neurological examination including a thorough assessment of mental status, cognitive functioning and gait and balance.
- A determination of the clinical status of the patient including whether there has been improvement or deterioration since the time of injury. This may involve seeking additional information from parents, coaches, teammates and eyewitness to the injury.
- A determination of the need for emergent neuroimaging in order to exclude a more severe brain injury involving a structural abnormality

In large part, these points above are included in the SCAT3 assessment

EXAM

- Cranial nerves
- Cerebellar exam
  - Rhomberg, Pronator drift, Finger-to-nose
- Strength exam
  - Upper and Lower
- Deep tendon reflex exam
  - Upper and Lower
- Balance exam
- Fundoscopic exam

INVESTIGATIONS

- Neuroimaging (CT, MRI)
  - Contributes little to concussion evaluation
  - Use when suspicion of cerebral or structural lesion exists:
    - focal neurologic deficit
    - worsening symptoms
    - Prolonged disturbance of conscious state
- Other modalities such as fMRI correlate with symptom severity and recovery and although not routinely used presently may provide additional insight.
- Alternative imaging technologies are still at early stage of development in concussion and not recommended other than research setting

INVESTIGATIONS

- Postural stability testing-deficits 72hr post concussion
  - Balance error scoring system (BESS), force plate technology
- Genetic testing/markers
  - Significance unclear for Apolipoprotein (Apo) E4, ApoE promoter gene, Tau polymerase, other genetic and cytokine factors
  - Insufficient evidence for routine clinical use

INVESTIGATIONS

Neuropsychological (NP) assessment:

- Important component in overall assessment and RTP
- Should NOT be sole basis of management decisions, but an aid to clinical decision making
- Included as part of clinical neurological assessment by treating physician often with computerized NP screening tools
- Formal NP testing not required for all but, if so, interpretation should be performed by trained neuropsychologist.
- Best done when asymptomatic but may be advantageous at other stages in particular situations
- Baseline testing not mandatory. May be helpful in test interpretation and for education opportunity

4. MANAGEMENT

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RECOVERY

- Majority (80-90%) resolve in short (7-10 day) period
- May take longer in children and adolescents

MANAGEMENT

- CORNERSTONE = initial period of rest until acute symptoms resolve
  - Physical Rest
    - No training, playing, exercise, weights
    - Beware of exertion with activities of daily living
  - Cognitive Rest
    - No television, extensive reading, video games?
    - Caution re: daytime sleep

MANAGEMENT

- Expect gradual resolution within 7-10 days
- Gradual return to school and social activities that does not result in significant exacerbation of symptoms
- Proceed through step-wise return to sport / play (RTP) strategy

RECOVERED?

- Everyone "*feels fine*"
- Always ask:

1. "*On a scale of 0 to 100%, how do you feel?*"
2. "*what makes you not 100%?*"
3. Symptom Checklist – SCAT3

GRADUATED RTP PROTOCOL

Rehabilitation stage	Functional exercise at each stage of rehabilitation	Objective of each stage
1. No activity	Symptom limited physical and cognitive rest.	Recovery
2.Light aerobic exercise	Walking, swimming or stationary cycling keeping intensity < 70% MPHR No resistance training.	Increase HR
3.Sport-specific exercise	Skating drills in ice hockey, running drills in soccer. No head impact activities.	Add movement
4.Non-contact training drills	Progression to more complex training drills e.g. passing drills in football and ice hockey. May start progressive resistance training	Exercise, coordination, and cognitive load
5.Full contact practice	Following medical clearance participate in normal training activities	Restore confidence and assess functional skills by coaching staff
6.Return to play	Normal game play	

- 24 hours per step (therefore about 1 week for full protocol)
- If recurrence of symptoms at any stage, return to previous asymptomatic level and resume after further 24 hr period of rest

SAME DAY RETURN TO PLAY?

- NO!
  - Unanimously agreed that no RTP should occur on the day of concussive injury

RETURN TO PLAY / SPORT

- Must pass graded exertion first
  =remain asymptomatic
- Is the athlete confident to go back?
- New helmet/head gear?
- Other “protective” equipment / behaviors / factors?
- Consider implications of multiple/recent injury

"DIFFICULT" OR PERSISTENTLY SYMPTOMATIC CONCUSSION PATIENT

- Persistent symptoms (>10 days) in about 10-15%
- Important to consider other issues
- Should be managed in multidisciplinary manner by healthcare providers experienced in sport concussion
  - In order to consider sub-symptom threshold exercise and other forms of therapy /rehabilitation

PSYCHOLOGICAL and PSYCHIATRIC ISSUES

- Psychological approaches may have application especially in selected situations (modifiers)
- Evaluate for affective symptoms (depression, anxiety) as common in all forms of traumatic brain injury
- Depression-may be consequence of concussion, underlying pathophysiological abnormality, may be multifactorial but should be considered in management

MANAGEMENT

- Pharmacotherapy
  - Prolonged symptoms (sleep disturbance, anxiety)
  - Modify underlying pathophysiology
- Upon return to play should not be on medication that could mask symptoms
  - Antidepressants?

5. MODIFYING FACTORS

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FACTORS	MODIFIER
Symptoms	Number Duration (>10 days) Severity
Signs	Prolonged LOC (>1min) Amnesia
Sequelae	Concussive convulsions
Temporal	Frequency –repeated concussion over time Timing – injuries close together “Recency” – recent concussion or TBI
Threshold	Repeated concussions occurring with progressively less impact force or slower recovery after each successive concussion
Age	Child and adolescent (< 18 years old)
Co and Pre-morbidities	Migraine, depression or other mental health disorders, attention deficit hyperactivity disorder (ADHD), learning disabilities (LD), sleep disorders
Medication	Psychoactive drugs Anticoagulants
Behaviour	Dangerous style of play
Sport	High risk activity Contact and collision sport High sporting level

MODIFIERS

- May influence investigation and management
- May predict potential for prolonged or persistent symptoms
- Multidisciplinary approach coordinated by a physician with specific expertise in management of concussion.

6. SPECIAL POPULATIONS

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CHILD AND ADOLESCENT ATHLETE

- Adult recommendations can apply down to age 13
- Below 13 require age appropriate symptom checklists and evaluation tool
  - child SCAT3 developed for this purpose
- Include both patient and parent, teacher, school input.
- Possibly use neuropsychological testing before symptoms resolve to help plan school management
  - must be developmentally sensitive, consider use of trained pediatric neuropsychologist

NOTE: Pediatric subcommittee has developed age-specific Child SCAT3 (Davis, McCrea, G. Gioia, Purcell, Ellenbogen, C. Vaughan, Guskiewicz, Kutcher, Meeuwisse, McCrory)

CHILD AND ADOLESCENT ATHLETE

- Consider age specific physical and cognitive rest issues
  - school attendance and activities need to be modified
- No return to sport or activity until returned to school successfully
- Symptom resolution may take longer, modifiers apply even more
- More conservative RTP approach recommended:
  - Consider extending symptom-free period before starting return to play protocol
  - Consider extending length of the graded exertion protocol
- Never return to play same day

ELITE VS NON-ELITE

- All athletes should be managed the same regardless of level of participation
- Available resources and expertise may determine management approaches
- Consider cognitive evaluation in all organized high-risk sports regardless of age or level of performance

7. OTHER ISSUES

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CHRONIC TRAUMATIC ENCEPHALOPATHY (CTE)

- Acknowledge potential for long-term problems in all athletes
- CTE unknown incidence in athletic populations, cause/effect not yet demonstrated between CTE and concussions or exposure to contact sport

PREVENTION

- Protective equipment
  - Mouthguards have benefit in prevention oral injury, but no evidence of concussion reduction
  - Head gear and helmets show reduction in biomechanical forces, but have not translated to a reduction in concussion incidence
  - Helmets reduce head and facial injury in skiing and snowboarding and are recommended for alpine sports
  - Helmets reduce other forms of head injury (e.g. fracture) in cycling, equestrian, motor sports

PREPARTICIPATION EVALUATION

- History:
  - Type of sport?
  - Previous symptoms of concussions?/length of recovery (recall unreliable from teammates, coaches)
  - Prior head, maxillofacial, spine injuries?
  - Non-sporting head injuries?
  - Type of player ("physical"?)
  - Ability to "take a hit"
  - Protective equipment (helmet age)
- Opportunity to Educate!

KNOWLEDGE TRANSFER

- Education of athletes, parents, coaches
- Awareness of concussion symptoms and signs
- Fair play and respect
- Role for web based resources, social media

SUMMARY: WHAT'S NEW?

- Evaluation on the "field of play"
- Postural stability assessment
- Timing of "rehabilitation"
- The difficult concussion patient
- Special populations
- New Tools
  - Sport Concussion Assessment Tool revision (SCAT3)
  - Child SCAT3
  - Concussion Recognition Tool (CRT) for lay use

SCENARIO 1 - CHALLENGE

- 18 year-old female rugby player who plays fly-half position. She went down at the end of a game. No clear memorable hit. MD called over to evaluate after whistle blew. She said “I just feel dizzy and nauseous.” Suffered a concussion earlier in the summer.
- Exam showed she had unsteadiness on her feet. Photophobia.
- SCAT3 was done.

RESPONSE

- How many people think she had a concussion?
- How many would send to the ER?
- How many would want a CT Scan?
- How many would schedule a follow up?
- What would be your next steps?

SCENARIO 2 - DISASTER

- 20 year old male playing intramural football. Collided with another player. He does not recall any of the events. His friends told him that he was “out cold.” Friends said he was breathing funny. He came to and was taken to the sideline. Looked kind of blue. Had numbness, tingling. Had trouble holding his head up. Ambulance was called.

RESPONSE

- How many people think he had a concussion?
- How many would send to the ER?
- How many would want a CT Scan?
- How many would schedule a follow up?
- What would be your next steps?

PART 2 – IN OFFICE

- CT Scan of Head was negative for acute findings
- Neuro exam was nonfocal
- Balance was off

SPORT CONCUSSION ASSESSMENT TOOL 3RD EDITION

SCAT3

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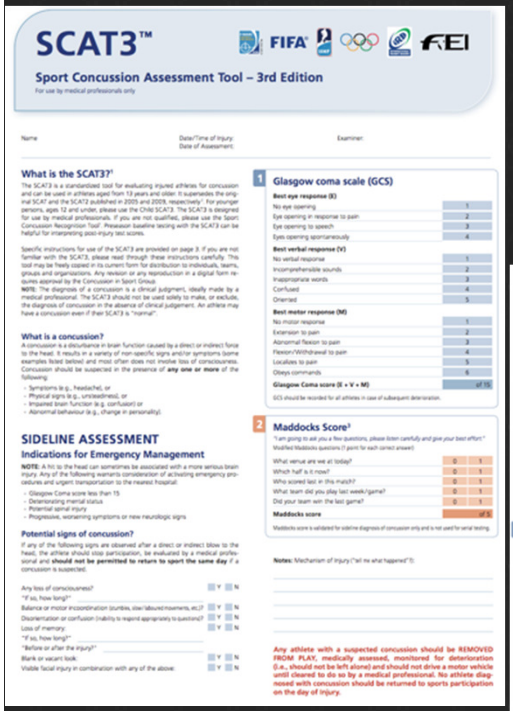
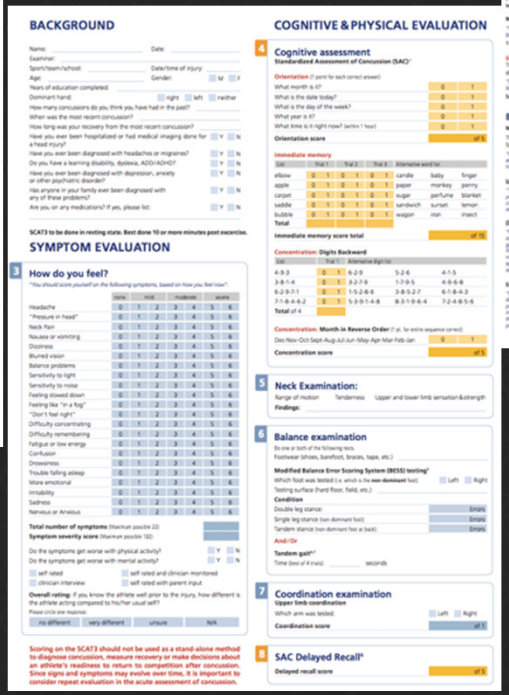
SCAT3 – 4 PAGE LAYOUT



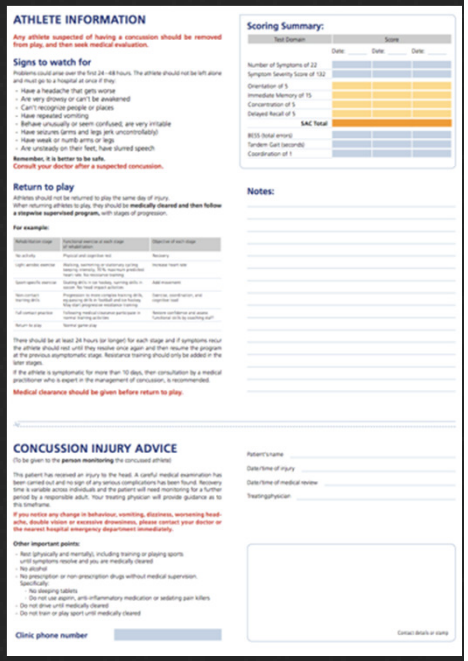
1. Sideline Assessment



2. Scoring

3. Instructions

4. Patient Information



SIDELINE ASSESSMENT

Indications for Emergency Management

NOTE: A hit to the head can sometimes be associated with a more serious brain injury. Any of the following warrants consideration of activating emergency procedures and urgent transportation to the nearest hospital:

- Glasgow Coma score less than 15
- Deteriorating mental status
- Potential spinal injury
- Progressive, worsening symptoms or new neurologic signs

Potential signs of concussion?

If any of the following signs are observed after a direct or indirect blow to the head, the athlete should stop participation, be evaluated by a medical professional and **should not be permitted to return to sport the same day** if a concussion is suspected.

Any loss of consciousness?	☐ Y	☐ N
"If so, how long?" _____		
Balance or motor incoordination (stumbles, slow/laboured movements, etc.)?	☐ Y	☐ N
Disorientation or confusion (inability to respond appropriately to questions)?	☐ Y	☐ N
Loss of memory:	☐ Y	☐ N
"If so, how long?" _____		
"Before or after the injury?" _____		
Blank or vacant look:	☐ Y	☐ N
Visible facial injury in combination with any of the above:	☐ Y	☐ N

1

Glasgow coma scale (GCS)

Best eye response (E)	
No eye opening	1
Eye opening in response to pain	2
Eye opening to speech	3
Eyes opening spontaneously	4
Best verbal response (V)	
No verbal response	1
Incomprehensible sounds	2
Inappropriate words	3
Confused	4
Oriented	5
Best motor response (M)	
No motor response	1
Extension to pain	2
Abnormal flexion to pain	3
Flexion/Withdrawal to pain	4
Localizes to pain	5
Obeys commands	6
Glasgow Coma score (E + V + M)	of 15

GCS should be recorded for all athletes in case of subsequent deterioration.

2 Maddocks Score[3]

"I am going to ask you a few questions, please listen carefully and give your best effort."

Modified Maddocks questions (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		of 5

Maddocks score is validated for sideline diagnosis of concussion only and is not used for serial testing.

BACKGROUND

Name: _____ Date: _____

Examiner: _____

Sport/team/school: _____ Date/time of injury: _____

Age: _____ Gender: ☐ M ☐ F

Years of education completed: _____

Dominant hand: ☐ right ☐ left ☐ neither

How many concussions do you think you have had in the past? _____

When was the most recent concussion? _____

How long was your recovery from the most recent concussion? _____

Have you ever been hospitalized or had medical imaging done for a head injury? ☐ Y ☐ N

Have you ever been diagnosed with headaches or migraines? ☐ Y ☐ N

Do you have a learning disability, dyslexia, ADD/ADHD? ☐ Y ☐ N

Have you ever been diagnosed with depression, anxiety or other psychiatric disorder? ☐ Y ☐ N

Has anyone in your family ever been diagnosed with any of these problems? ☐ Y ☐ N

Are you on any medications? If yes, please list: ☐ Y ☐ N

_____

3 How do you feel?

"You should score yourself on the following symptoms, based on how you feel now".

	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
Trouble falling asleep	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

Total number of symptoms (Maximum possible 22)

Symptom severity score (Maximum possible 132)

Do the symptoms get worse with physical activity? ☐ Y ☐ N

Do the symptoms get worse with mental activity? ☐ Y ☐ N

☐ self rated ☐ self rated and clinician monitored

☐ clinician interview ☐ self rated with parent input

Overall rating: If you know the athlete well prior to the injury, how different is the athlete acting compared to his/her usual self?

Please circle one response:

no different	very different	unsure	N/A

4

Cognitive assessment

Standardized Assessment of Concussion (SAC)[4]

Orientation (1 point for each correct answer)

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

Immediate memory

List	Trial 1		Trial 2		Trial 3		Alternative word list		
elbow	0	1	0	1	0	1	candle	baby	finger
apple	0	1	0	1	0	1	paper	monkey	penny
carpet	0	1	0	1	0	1	sugar	perfume	blanket
saddle	0	1	0	1	0	1	sandwich	sunset	lemon
bubble	0	1	0	1	0	1	wagon	iron	insect
Total									

Immediate memory score total of 15

Concentration: Digits Backward

List	Trial 1		Alternative digit list		
4-9-3	0	1	6-2-9	5-2-6	4-1-5
3-8-1-4	0	1	3-2-7-9	1-7-9-5	4-9-6-8
6-2-9-7-1	0	1	1-5-2-8-6	3-8-5-2-7	6-1-8-4-3
7-1-8-4-6-2	0	1	5-3-9-1-4-8	8-3-1-9-6-4	7-2-4-8-5-6
Total of 4					

Concentration: Month in Reverse Order (1 pt. for entire sequence correct)

Dec-Nov-Oct-Sept-Aug-Jul-Jun-May-Apr-Mar-Feb-Jan	0	1
Concentration score		of 5

5 Neck Examination:

Range of motion Tenderness Upper and lower limb sensation & strength

Findings: _____

6 Balance examination

Do one or both of the following tests.

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

Modified Balance Error Scoring System (BESS) testing[5]

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

Testing surface (hard floor, field, etc.) _____

Condition

Double leg stance:	Errors
Single leg stance (non-dominant foot):	Errors
Tandem stance (non-dominant foot at back):	Errors

And / Or

Tandem gait[6,7]

Time (best of 4 trials): _____ seconds

7 Coordination examination

Upper limb coordination

Which arm was tested: ☐ Left ☐ Right

Coordination score	of 1

8 SAC Delayed Recall[4]

Delayed recall score	of 5

Scoring Summary:

Test Domain	Score		
	Date: _____	Date: _____	Date: _____
Number of Symptoms of 22			
Symptom Severity Score of 132			
Orientation of 5			
Immediate Memory of 15			
Concentration of 5			
Delayed Recall of 5			
SAC Total			
BESS (total errors)			
Tandem Gait (seconds)			
Coordination of 1			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