

Sports Concussion: Diagnosis, Management and Follow-up

Defense Centers of Excellence for
Psychological Health & Traumatic Brain Injury

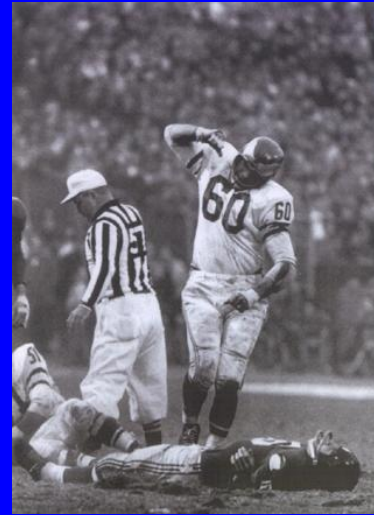
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Concussions Change Lives



Key Literature

1. McCrory, et al: Consensus Statement on Concussion in Sport: The 3rd International Conference on Concussion in Sport, Zurich, November 2008. **J Athl Train.** 44(4):434-448, 2009.
2. Guskiewicz et al: National Athletic Trainers' Association Position Statement: Management of Sports-Related Concussion. **J Athl Train** 39:280-297, 2004.
3. Herring et al: ACSM Concussion (Mild Traumatic Brain Injury) and the Team Physician: A Consensus Statement. **Med Sci Sports Exerc** 38(2): 395-399, 2006.

Concussion basics

- Complex pathophysiological process affecting the brain, induced by traumatic biomechanical forces.
- Several common features
 - Direct blow or transmitted force
 - Rapid onset/short lived/spontaneous recovery
 - Largely functional rather than structural
 - May or may not involve Loss of Consciousness
 - Typically normal conventional neuroimaging

Concussion Grading Systems

Over 25 Published Severity Scales

TABLE 3. Common concussion grading scales

	Cantu evidence-based scale ¹	AAN practice parameter ²	Colorado Medical Society ³
Grade 1	No LOC; PTA or postconcussion signs or symptoms <30 min	Transient confusion; no LOC; concussion symptoms or mental status abnormalities on examination resolve in <15 min	Confusion without amnesia; no LOC
Grade 2	LOC <1 min; PTA or postconcussion signs or symptoms >30 min but <24 h	Transient confusion; no LOC; concussion symptoms or mental status abnormalities on examination last >15 min	Confusion with amnesia; no LOC
Grade 3	LOC >1 min or PTA >24 h; postconcussion signs or symptoms >7 d	Any LOC, either brief (seconds) or prolonged (minutes)	LOC

Key: AAN, American Academy of Neurology; LOC, loss of consciousness; PTA, posttraumatic amnesia (retrograde and anterograde).

1. Cantu RC. Posttraumatic retrograde and anterograde amnesia: pathophysiology and implications in grading and safe return to play. *J Athl Train*. 2001;36(3):244-248.

2. Practice Parameter: the management of concussion in sports (summary statement). Report of the Quality Standards Subcommittee. *Neurology*. 1997;48(3):581-585.

3. The Sports Medicine Committee Colorado Medical Society. *Guidelines for the Management of Concussion in Sports*. Denver, Colo: Colorado Medical Society; 1991.

Recommend abandonment of
grading systems and focus on
symptom-based severity

Clinical Presentation of Concussion

- Cognitive Features
 - Amnesia
 - Confusion
 - Unaware
- Typical Symptoms
 - Headache
 - Nausea
 - Dizziness
 - Emotional
 - Visual
 - Auditory
- Physical Signs
 - Impaired Consciousness
 - Coordination
 - Slow to answer
 - Poor concentration
 - Inappropriate emotion
 - Vomiting
 - Slurred speech
 - Decreased performance ability

Evaluation of Concussion

- Pre-Event Preparation
- Immediate
 - Systematic
 - Protect the C-spine
 - Determine initial disposition
- Delayed
 - Maintain control
 - More detailed History and Physical
 - Cognitive, somatic and affective symptoms
 - Serial neurological assessment
 - Disposition and post-injury follow-up
 - Objective balance assessment
 - Neuroimaging

Concussion Management

- Physical and Mental Rest
- Individualized
- Gradual and Progressive
- Close and Frequent Re-assessment
- Loss of Consciousness
- Amnesia
- Neuropsychology Screening
- Psychological Management
- Pharmacological Management



Sports Concussion Assessment Tool 2

SCAT2

Sport Concussion Assessment Tool 2

Name _____

Sport/team _____

Date/time of injury _____

Date/time of assessment _____

Age _____ Gender M F

Years of education completed _____

Examiner _____

Symptom Evaluation

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 (if applicable)	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) _____ of 22

Symptom severity score
(Add all scores in table, maximum possible: 22 x 6 = 132) _____ of 132

Do the symptoms get worse with physical activity? Y N

Do the symptoms get worse with mental activity? Y N

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

What is the SCAT2?
This tool represents a standardized method of evaluating injured athletes for concussion and can be used in athletes aged from 10 years and older. It supersedes the original SCAT published in 2005¹. This tool also enables the calculation of the Standardized Assessment of Concussion (SAC)¹⁻⁴ score and the Maddocks questions⁵ for sideline concussion assessment.

Instructions for using the SCAT2
The SCAT2 is designed for the use of medical and health professionals. Preseason baseline testing with the SCAT2 can be helpful for interpreting post-injury test scores. Words in Italics throughout the SCAT2 are the instructions given to the athlete by the tester.

This tool may be freely copied for distribution to individuals, teams, groups and organizations.

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 symptoms (like those listed below) and often does not involve loss of consciousness. Concussion should be suspected in the presence of **any one or more** of the following:

- Symptoms (such as headache), or
- Physical signs (such as unsteadiness), or
- Impaired brain function (e.g. confusion) or
- Abnormal behaviour.

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.

SCAT2 SPORT CONCUSSION ASSESSMENT TOOL 2 | PAGE 1

Cognitive & Physical Evaluation

1 Symptom score (from page 1)
22 minus number of symptoms _____ of 22

2 Physical signs score
Was there loss of consciousness or unresponsiveness? Y N
If yes, how long? _____ minutes
Was there a balance problem/unsteadiness? Y N
Physical signs score (1 point for each negative response) _____ of 2

3 Glasgow coma scale (GCS)
Best eye response (E)
No eye opening 1
Eye opening in response to pain 2
Eye opening to speech 3
Eye 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.

4 Sideline Assessment – Maddocks Score
"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)
At 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 included in SCAT 2 summary score for serial testing.

5 Cognitive assessment
Standardized Assessment of Concussion (SAC)
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
"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 & 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."
Complete all 3 trials regardless of score on trial 1 & 2. Read the words at a rate of one per second. Score 1 pt. for each correct response. Total score equals sum across all 3 trials. Do not inform the athlete that delayed recall will be tested.

	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	seriset	lemon
bubble	0	1	0	1	0	1	wagon	iron	insect

Total _____ of 15

Immediate memory score _____ of 15

Concentration
Digits Backward:
"I am going to read you a string of numbers and when I am done, you repeat them back to me backwards, in reverse order of how I read them to you. For example, if I say 7-1-5, you would say 5-1-7."
If correct, go to next string length. If incorrect, read trial 2. One point possible for each string length. Stop after incorrect on both trials. The digits should be read at the rate of one per second.

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

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!"
1 pt. for entire sequence correct
Dec-Nov-Oct-Sept-Aug-Jul-Jun-May-Apr-Mar-Feb-Jan 0 1

Concentration score _____ of 5

¹ This tool has been developed by a group of international experts at the 3rd International Consensus meeting on Concussion in Sport held in Zurich, Switzerland in November 2008. The full details of the conference outcomes and the authors of the tool are published in British Journal of Sports Medicine, 2009, volume 43, supplement 1.
The outcome paper will also be simultaneously co-published in the May 2009 issues of Clinical Journal of Sports Medicine, Physical Medicine & Rehabilitation, Journal of Athletic Training, Journal of Clinical Neuroscience, Journal of Science & Medicine in Sport, Neurosurgery, Scandinavian Journal of Science & Medicine in Sport and the Journal of Clinical Sports Medicine.

² McCrea M, Dickler G, Selig MA. The assessment of orientation following concussion in athletes. Clin J Sport Med. 1995;5(1):32-3.

³ Gudavicius RM. Assessment of postural stability following sport-related concussion. Current Sports Medicine Reports. 2003; 2: 24-30.

⁴ McCrea M, Randolph C, Kelly J. Standardized Assessment of Concussion: Manual for administrators, scoring and interpretation. Waukegan, Wisconsin, USA.

⁵ Maddocks DL, Dickler GD, Selig MA. The assessment of orientation following concussion in athletes. Clin J Sport Med. 1995;5(1):32-3.

⁶ McCrea M. Standardized mental status testing of acute concussion. Clinical Journal of Sports Medicine. 2001; 11: 176-181.

SCAT2 SPORT CONCUSSION ASSESSMENT TOOL 2 | PAGE 2

Concussion Prevention

- Equipment modification
- Mouthpieces
- Rule changes
- Rule enforcement
- Identification and treatment
- Technique
- Strengthening



Future Direction in Concussion Management

- Pre-participation Concussion Evaluation
- Gender and Age Considerations
- Rehabilitation Strategies
- Long-term Outcomes
- Rule and Equipment Changes
- Education

Final Comments



- High index of suspicion
- Have a plan
- Share the plan
- Keep current
- “When in doubt, hold them out.”