

**RETURN TO PLAY AFTER
CONCUSSION**

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Financial Disclosure

Dr. Thomas Kingman has no relevant financial relationships with commercial interests to disclose.

Concussion

- Latin *concussus* meaning “to shake violently”
- Immediate & transient alteration of mental status & level of consciousness resulting from mechanical force or trauma
- Confusion is the hallmark of concussion

Things to Remember:

- High school and younger athletes are more vulnerable to concussion and longer to recover from concussion than older athletes.
They should NOT return to play the same day of injury.
- Girls are more vulnerable than boys.
- Return to play should be individualized.
- Concussions are cumulative.

Total number of sports related head impacts – 354,000,000/yr

- 40,000 concussions/yr in H.S. football
- 5-20% of players get concussions
- 90% mild – no loss of consciousness
- 30% return to play same day
- 60% athletes claim they made the decision to return to play independent of trainer or team physician

ANY SPORT HAS AN INHERENT RISK OF INJURY.

Unique to athletic injuries is that the player is intentionally subjected to repetitive cranial trauma

- Tackling
- Heading the ball

Nature of concussive head injury

- Concussion may be caused by a direct blow to the head, face, neck, or elsewhere on the body with an “impulsive” force transmitted to the head.

Nature of concussive head injury

- Concussion typically results in the rapid onset of short lived impairment of neurological function that resolves spontaneously

Nature of concussive head injury

- Concussion results in a graded set of clinical syndromes that may or may not involve loss of consciousness
- Resolution of the clinical and cognitive symptoms typically follows a sequential course

Only 9.3% of NFL players who sustain a concussion had a loss of consciousness. Now 11 lawsuits against the NFL for repeated concussions and resultant long term consequences.

Nature of concussive head injury

- Concussion is typically associated with grossly normal structural neuroimaging studies
- Functional MRI may be abnormal
- MRI Spectroscopy may be abnormal for a month

The risk of concussion is 4 times higher in a previously concussed player than in a player who has never sustained a concussion.

Concussion (Mild Traumatic Brain Injury)

- Structural damage with loss of brain cells does occur with some concussions
- Repeated concussions additive – slower/less complete recovery
- Second Impact Syndrome – 100% morbidity, 50% mortality (only occurs in youth)

CLOSE OBSERVATION AND ASSESSMENT OF THE INJURED ATHLETE COULD BE CRITICAL TO THE PREVENTION OF CATASTROPHIC BRAIN INJURY AND CUMULATIVE NEUROPSYCHOLOGICAL DEFICITS.

THE CONFUSIONAL EPISODE AND AMNESIA MAY OCCUR IMMEDIATELY AFTER THE BLOW TO THE HEAD OR SEVERAL MINUTES LATER. CLOSE OBSERVATION AND ASSESSMENT OF THE ATHLETE OVER SOME PERIOD OF TIME IS NECESSARY TO DETERMINE WHETHER EVOLVING NEUROPATHOLOGIC CHANGE ASSOCIATED WITH CONCUSSION WILL LEAD TO A CONFUSIONAL STATE OR TO THE DEVELOPMENT OF MEMORY DYSFUNCTION.

Confusion

- Disturbance of vigilance/heightened distractibility
- Inability to maintain a coherent stream of thought
- Inability to carry out a sequence of goal-directed movements

Disorientation may be present but subtle mental status abnormalities more common

- Problems with new learning memory
- Problems attention and concentration
- Problems of cognitive processing speed
- Problems of complex operations related to working memory

EARLY (minutes and hours) SYMPTOMS OF CONCUSSION

HEADACHE

DIZZINESS OR VERTIGO

LACK OF AWARENESS OF SURROUNDINGS

NAUSEA OR VOMITING

LATE (days to weeks) SYMPTOMS OF CONCUSSION

PERSISTENT LOW GRADE HEADACHE

LIGHT-HEADEDNESS

POOR ATTENTION AND CONCENTRATION

MEMORY DYSFUNCTION

EASY FATIGUABILITY

IRRITABILITY AND LOW TOLERANCE

INTOLERANCE OF BRIGHTLIGHTS OR DIFFICULTY FOCUSING VISION

INTOLERANCE OF LOUD NOISES, SOMETIMES RINGING IN THE EARS

ANXIETY AND/OR DEPRESSED MOOD

SLEEP DISTURBANCE

TABLE 1: FEATURES OF CONCUSSION FREQUENTLY OBSERVED

- VACANT STARE (BEFUDDLED FACIAL EXPRESSION)
- DELAYED VERBAL AND MOTOR RESPONSES (SLOW TO ANSWER QUESTIONS OR FOLLOW INSTRUCTIONS)
- CONFUSION AND INABILITY TO FOCUS ATTENTION (EASILY DISTRACTED AND UNABLE TO FOLLOW THROUGH WITH NORMAL ACTIVITIES)

TABLE 1: FEATURES OF CONCUSSION FREQUENTLY OBSERVED

- DISORIENTATION (WALKING IN THE WRONG DIRECTION, UNAWARE OF TIME, DATE, AND PLACE)
- SLURRED OR INCOHERENT SPEECH
- GROSS OBSERVABLE INCOORDINATION
- EMOTIONS OUT OF PROPORTION TO CIRCUMSTANCES
- MEMORY DEFICITS
- ANY PERIOD OF LOSS OF CONCIUSNESS

http://www.cces.ca/files/pdfs/SCAT2[1].pdf

SCAT2
Sport Concussion Assessment Tool 2

Symptom Evaluation

How do you feel?
 Headache None Mild Moderate Severe
 Dizziness None Mild Moderate Severe
 Nausea None Mild Moderate Severe
 Vomiting None Mild Moderate Severe
 Balance problems None Mild Moderate Severe
 Irritability None Mild Moderate Severe
 Fatigue None Mild Moderate Severe
 Sensitivity to light None Mild Moderate Severe
 Sensitivity to sound None Mild Moderate Severe
 Sensitivity to heat None Mild Moderate Severe
 Sensitivity to cold None Mild Moderate Severe
 Blurred vision None Mild Moderate Severe
 Double vision None Mild Moderate Severe
 Head pressure None Mild Moderate Severe
 Slurred speech None Mild Moderate Severe
 Inattention None Mild Moderate Severe
 Memory None Mild Moderate Severe
 Irritability None Mild Moderate Severe
 Anxiety None Mild Moderate Severe
 Sadness None Mild Moderate Severe
 Irritability None Mild Moderate Severe
 Depression None Mild Moderate Severe
 Loss of consciousness None Mild Moderate Severe
 Loss of consciousness (minutes) None Mild Moderate Severe
 Loss of consciousness (hours) None Mild Moderate Severe
 Loss of consciousness (days) None Mild Moderate Severe
 Loss of consciousness (weeks) None Mild Moderate Severe
 Loss of consciousness (months) None Mild Moderate Severe
 Loss of consciousness (years) None Mild Moderate Severe

Cognitive & Physical Evaluation

1 Symptom score
 0-15
 0 = No symptoms
 1-15 = Mild to severe symptoms

2 Physical signs score
 0-15
 0 = No signs
 1-15 = Mild to severe signs

3 Glasgow coma scale (GCS)
 3-15
 3 = Severe
 4 = Moderate
 5 = Moderate/severe
 6 = Severe/moderate
 7 = Moderate
 8 = Moderate/severe
 9 = Severe/moderate
 10 = Severe
 11 = Moderate/severe
 12 = Moderate
 13 = Severe/moderate
 14 = Severe
 15 = Moderate/severe

4 Balance examination

5 Cognitive Assessment - Modified Score

6 Balance examination

7 Athlete injury advice

http://www.cces.ca/files/pdfs/SCAT2[1].pdf

8 Balance examination

9 Coordination examination

10 Cognitive assessment

11 Athlete information

12 Signs to watch for

13 Return to play

14 Concussion injury advice

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TABLE 3 SIDELINE EVALUATION	
MENTAL STATUS TESTING	
ORIENTATION	TIME, PLACE, AND SITUATION
CONCENTRATION	DIGITS BACKWARD MONTHS OF THE YEAR IN REVERSE ORDER
MEMORY	NAMES OF TEAMS IN PRIOR CONTEST; RECALL OF 3 WORDS AND 3 OBJECTS AT ZERO AND 5 MINUTES; RECENT NEWSWORTHY EVENTS; DETAILS OF THE CONTEST

Sideline assessment	
<ul style="list-style-type: none"> ■ Serial sevens ■ Immediate recall – Digit span test ■ Days of the week/ Months of the year in reverse order ■ Spelling words backwards 	

TABLE 3 SIDELINE EVALUATION	
NEUROLOGIC TESTS	
PUPILS	SYMMETRY AND REACTION
COORDINATION	FINGER-NOSE-FINGER, TANDEM GAIT
SENSATION	FINGER-NOSE (EYES CLOSED) AND ROMBERG

Balance Error Scoring System (UNC)

- Six 20 second tests
- Both legs, single non-dominant leg, tandem stance
- Firm surface/foam surface
 - 10 cm thick medium density foam
- Hands on iliac crests
- Eyes closed
- Maximum error score of 10

Balance Error Scoring System

Errors

- hands lifted off iliac crest
- opening eyes
- step, stumble or fall
- moving hip into more than 30% of flexion or abduction
- lifting forefoot or heel
- remaining out of testing position for more than 5 seconds

TABLE 3 SIDELINE EVALUATION

EXTERNAL PROVOCATIVE TESTS

40 YARD SPRINT;

5 PUSHUPS;

5 SIT UPS;

5 KNEEBENDS

SAC better if have pre-injury baseline.
Also allows for following recovery.

Contraindications to return to sport

- No one plays the same day
- Persistent post-concussive symptoms
- Abnormal neurologic exam
- Symptoms on exertion
- Abnormalities on cognitive testing
- Abnormalities on imaging

In place of a single grading scale and in the absence of any scientifically validated return-to-play guidelines, the participants recommended the use of a clinical construct based on an assessment of recovery from injury and graded return to play.

The number, duration and severity of total postconcussion symptoms were most important in determining concussion severity and that the combination of symptoms were more important than the single symptom of amnesia.

Simple concussion

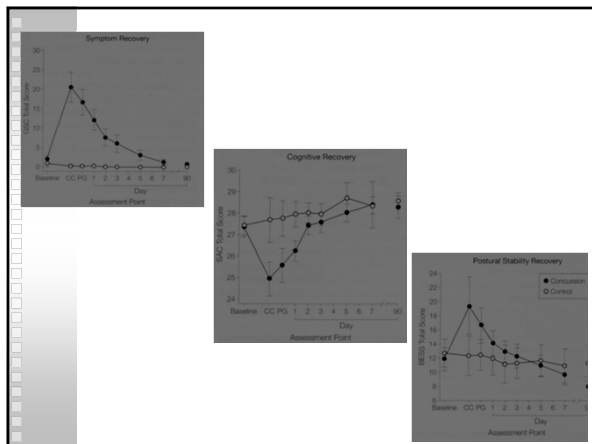
- One in which the neurological symptoms resolves within 7 to 10 days

Complex concussion

- One in which the symptoms persisted longer than 10 days
- Patient had loss of consciousness for longer than a minute
- Patient had a convulsive concussion
- Patient had repeated concussions involving diminishing force

Consequently, concussion severity cannot be determined on the day of the concussion, but rather only after all symptoms have resolved. As a result, no guideline is given for return to play.

1 FULL
ASYMPTOMATIC
WEEK



Vestibular testing/Posturography

- Clearly abnormal in concussion
- Can use to follow recovery
- Need equipment , i.e. cost
- Pre-injury testing helpful
- Recovery follows same timeline as recovery measured by neuropsychological testing

Computerized Concussion Management?

Programs increasingly available

- CogState
- Headminder - CRE
- ImPACT
- Automated Neuropsychological Assessment Metric (ANAM)

How they work

- Baseline test usually taking 20 minutes, testing brain processing speed, memory, and visual motor skills
- Repeat testing at regular intervals after head injury occurs
- Goal is to gauge when athlete has returned to his/her baseline

Shortcomings of testing

- Does not supplant clinical evaluation
- Computerized testing has to be validated against the full battery of neuropsychological tests that have traditionally been used
- Problem arises when a psychological test is marketed to non-psychologists who may not have the training to make an independent judgment

Return to Play

- Decisions regarding concussion management and return to play lie largely in the realm of clinical judgment and must be made on an individual basis

Return to play

- No athlete returns to play until they are asymptomatic at rest and exertion and must remain asymptomatic with exertion
- Ideally, neuropsychological testing would have been done and returned to normal
- Postural stability is normal

Return to play

- Severity of the current injury is documented primarily by the number and duration of postconcussion symptoms

Return to play

- The number, severity and proximity of previous concussions
- Whether a severe injury had occurred in response to what appeared to be a minor blow
- Age of athlete
- Gender of athlete

Return to play

- Sport involved
- Athlete had a pre-existing learning disability
- Neurologic examination
- Neuropsychological testing

Table 3

Vienna concussion conference: return to play recommendations. Athletes should complete the following stepwise process before return to play following concussion

1. Removal from contest following sign/symptoms of concussion
2. No return to play in current game
3. Medical evaluation following injury
 - a. Rule out more serious intracranial pathology
 - b. Neuropsychological testing considered
"cornerstone" of proper post injury assessment

Table 3, continued

4. Stepwise return to play
 - a. No activity and rest until asymptomatic
 - b. Light aerobic exercise
 - c. Sport-specific training
 - d. Non-contact drills
 - e. Full-contact drills
 - f. Game play

THE LOSS OF OBJECTIVITY ON THE PART OF THE ATHLETE, FAMILY, COACHES, SPORTS MEDIA, AND SPECTATORS IS AN UNFORTUNATE AND POTENTIALLY HARMFUL BIAS.

Use of new helmets creates a 20% decrease in concussions.

No effect on subconcussive forces.

Resources

- Neurosurgical Focus/Volume 21/October, 2006 – *An overview of concussion consensus statements since 2000* (Cantu)
- Clinics in Sports Medicine/Volume 28/January, 2009 – *The Management of Sports-Related Concussion: Current Status and Future Trends* (Lovell)

Things to Remember:

- High school and younger athletes are more vulnerable to concussion and longer to recover from concussion than older athletes.
They should NOT return to play the same day of injury.
- Girls are more vulnerable than boys.
- Stepwise return to play should be individualized.
- Concussions are cumulative.
- Recognition, technique and proper equipment are critical.

Lystedt Laws - Coaches

- Coaches are required to sign a statement indicating that they have been educated as to the nature and risk of head injuries.
- If a coach suspects that a player has a head injury, (s)he is required to immediately remove that player from the practice or game: "When in doubt, sit them out."
- A player that has been removed from competition cannot return to play until (s)he has been evaluated by a licensed health care provider trained in the evaluation and management of concussion and has received written clearance to return to play from that health care provider.
- Finally, coaches are responsible for educating their athletes regarding the nature and risk of head injuries, and encouraging athletes to notify a coach if they notice signs of a head injury in themselves or their teammates.

Lystedt Laws – Parents/Guardians

- **Parents/Guardians are required to review and sign an annual concussion and head injury information sheet prior to their children's participation in athletic events.**

Lystedt Laws - Athletes

- Athletes are required to review and sign an annual concussion and head injury information sheet prior to their participation in athletic events. If they suspect a head injury in themselves or a teammate, they are encouraged to tell their coach

Future Directions

- New game rules?
- New return to play directives?
- New equipment?
- Genetic and biomarkers?

All concussions are serious

- Don't hide it
- Report it
- Take time to recover
- It's better to miss one game than the whole season
