

## **Atrial fibrillation in athletes**

Atrial fibrillation is the most common arrhythmia seen in athletes. Sinus bradycardia would be regarded as an exaggeration of the normal physiological response to aerobic training with vagal predominant influence over cardiac function.

The presentation can often be dramatic, e.g. Rob Waddell described the onset of his atrial fibrillation at the 300m mark in the third of the trial races for the singles berth at the Olympics as being like 'rowing through mud'.

Management involves early recognition of the condition and classically the symptom is of an irregularly irregular pulse with varying pulse volume. Some athletes are very astute at describing this sensation. There may or may not be a sensation of palpitations, an abnormal sensation of the heart beating within the chest. Documentation with ECG is essential.

Correction to sinus rhythm at the earliest available opportunity is highly desirable. This may be achieved by use of intravenous Flecainide on occasion, but from time to time there will be the need for DC cardioversion. If the athlete has been in atrial fibrillation for longer than a day or two there is a need to anticoagulate them prior to DC cardioversion. The aim is to then maintain sinus rhythm and look for precipitating causes, e.g. sympathomimetic drugs, caffeine or so-called energy drinks which contain high amounts of caffeine. Other stimulants can provide the same effect. Alcohol is also a known precipitant of atrial fibrillation.

The athlete's highest priority is to be able to resume their normal training and, once sinus rhythm has been re-established, usually this can occur within days. The athlete should be monitored a week or so after their first event and keep a symptom diary so their condition can be adequately monitored.

Depending on a range of factors, there may be the need for regular medication to prevent breakthrough episodes of atrial fibrillation. Radiofrequency ablation is another treatment option. All of these issues need detailed discussion with the athlete and their cardiologist.

**Chris Milne**  
Sports Physician  
Anglesea Sports Medicine  
Hamilton

## Soft tissue injections for the GP

### Basic Principles

1. *"There is no body cavity that can't be reached with a 14 gauge needle and a good strong arm"* (Samuel Shem - House of God)
2. The smaller the needle calibre, the less it will hurt (I use 25 gauge needles)
3. Local anaesthesia mixed with your choice of injectate can help confirm needle placement without the need for ultrasound in many cases
4. The injection works best as part of a total treatment package; an exercise rehabilitation regime is the evidence-based treatment for tendon problems in the 21<sup>st</sup> Century, and cortisone injections provide a 2-3 month window to enable the person to do their exercises
5. Beware the post injection flare

### What can be injected?

1. Corticosteroids - anti-inflammatory
  - a. Triamcinolone (Kenacort)
  - b. Methylprednisolone (Depo-Medrol)
  - c. Betamethasone (Celestone)
2. Blood / protein rich plasma (PRP) - growth factor
3. Prolotherapy, e.g. hypertonic glucose - soft tissue irritant - provoke a local soft tissue response
4. Cartilage ? preservers / retainers, e.g. OS (OsteoArtz, Synvisc)

### Guided or unguided injections

1. Be selective
2. Ultrasound guidance adds about \$200 to costs ?? does this equate to being more cost-effective in all cases
3. A decision re treatment should ideally be made by a clinician
4. My recommendations for considering ultrasound guidance:
  - a. Small tendons, e.g. de Quervain's (APL and EPB)
  - b. Deepseated structures, e.g. iliopsoas
  - c. A significantly swollen bursa has been seen on ultrasound scan
  - d. A previous unguided injection to the same site, by an experienced clinician, has *not* been effective

**Chris Milne**  
Sports Physician  
Hamilton  
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# LOCAL CORTICOSTEROID INJECTIONS

## Introduction

Your doctor has recommended you have a local steroid injection to help treat your painful joint, muscle or tendon problem. This simple guide answers some of the common questions asked about these injections.

## What are steroids?

Steroids are a large group of drugs, with many different properties. There are three main types:

1. Corticosteroids: powerful anti-inflammatory drugs used to treat asthma, arthritis and other conditions.
2. Male sex hormones: androgenic anabolic steroids. These are used to treat androgen deficiency and male infertility. Some people use them for "bulking up". They are **BANNED DRUGS** and have no place in injury treatment.
3. Female sex hormones: eg, estrogens, progestogens. These are used "in the Pill" for contraception and also as Hormone Replace Therapy (HRT) after menopause.

## What do corticosteroid injections do?

They cause a powerful anti-inflammatory action. This should lead to:

1. Removal of debris from the injury site.
2. Reduction of pain and swelling.
3. Greater range of motion.
4. Properly alignment of scar tissue as injury repair takes place.
5. A return to sport and other important life activities.

## What injuries are they used for?

1. Inflamed joint with excess fluid (effusion).
2. Inflamed bursa (fluid sac around a joint).
3. Inflamed tendons and tendon sheaths.
4. Soft tissues that are being pinched (impingement).
5. Frozen shoulder.

They have been used for these injuries for over 40 years, with very good results in most cases.

| BENEFITS                       | RISKS (SIDE EFFECTS)                                                                                                                                                                                                                                                                                            |
|--------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Relieve pain.                  | <b>Common (up to 10%)</b><br>Dimpling and loss of skin pigment around the injection site. This can be permanent. It is mainly a problem with tennis elbow injections, and those around the Achilles tendon.                                                                                                     |
| Reduce swelling.               | <b>Uncommon (up to 5%)</b>                                                                                                                                                                                                                                                                                      |
| Improve healing.               | 1. Post-injection flare. A few hours after the injection you may get a worsening of pain and swelling. This usually settles in a day or two with ice packs and tablets. Take 3 x 300 mg Dispirin dissolved in half a glass of water every 3-4 hours. Alternatively, use Paracetamol 2 x 500 mg every 4-6 hours. |
| Allow return to full activity. | 2. Skin <del>flaking</del> <sup>thinning</sup> , especially of the face, may occur for up to a few days. This needs no specific treatment and will settle with time.                                                                                                                                            |
|                                | <b>Rare (less than 1%)</b><br>Tendon rupture - avoid heavy exercise of the injected part for at least a week.                                                                                                                                                                                                   |
|                                | <b>Very Rare (much less than 1%)</b><br>Infection can very rarely complicate any injection. If the area around the injection site becomes hot and red, contact the doctor who performed the injection for further advice.                                                                                       |
|                                | <i>In women only;</i> your next period after the injection may be heavier than normal. This is probably due to temporary hormonal changes related to the injection and does not usually require further investigation. It usually occurs in women over the age of 30.                                           |
|                                | <i>In people with diabetes;</i> you may notice a rise in your blood sugar level for a few days after the injection. Some people may need to use extra insulin.                                                                                                                                                  |

## After your injection:

- Especially if you have had an injection that includes local anaesthetic, be very careful not to stress the area.
- People doing light or office work can continue at work. If you are doing heavy work you should check with your doctor.
- Do **NOT** attempt any heavy lifting, eg, moving a heavy table or doing heavy weights.
- After several days you may return to light training that avoids stressing the injected area.
- At about the one week stage you can plan an ongoing recovery programme in conjunction with your doctor and physiotherapist.
- About one month after the injection you should see your doctor for a follow-up check.
- PLMBHLR, the injection is not a cure. It works best as part of a total treatment plan with progressively increasing training over several weeks.
- For athletes subject to drug testing, you must complete a Declaration of Use (DOU) form. This can be completed electronically. Go to the website for DrugFree Sport New Zealand - [www.drugfreesport.org.nz](http://www.drugfreesport.org.nz) - and follow the links.

Reference: A Practical Guide to Joint and Soft Tissue Injections, James W McElduff, Lippincott Williams and Williams, Philadelphia, 2003

Dr Chris Milne, Sports Physician

Revised January 2010

## Medical Screening and Periodic health Evaluations for Athletes

### Typical GP scenarios

1. Club doctor for local rugby, league, netball or cricket team
2. Event doctor for a fun run, triathlon or other endurance event

### A. Most important information comes from the history:

1. Background - past injuries and medical problems ? resolved / active
2. Previous operations
3. Allergies
4. Control of medical problems:

#### e.g. Asthma

Symptoms - Post-exercise cough / wheeze; sleep disturbance

Causes of poor control:

- a. Recent URTI / chest infection
- b. Sinus disease
- c. Reflux oesophagitis
- c. Poor inhaler technique
- d. Inadequate inhaled steroid / Cromoglycate

#### e.g. Diabetes

Symptoms - Hyper: Polyuria / polydipsia; infections; fatigue

Hypo: Morning headache; fatigue

Testing - HbA1c

#### e.g. Epilepsy

Symptoms - Breakthrough seizures; missed medication; alcohol; other drugs that lower seizure threshold

### B. Examination

CVS - Pulse, BP, heart sounds  
Respiratory - Upper airways, chest, PFR at rest, post-exercise  
Abdomen - Organomegaly, especially post-glandular fever  
CNS - Mental status, localising signs, gait, balance / proprioception  
MSK - Ben Rose screening tool, examine previously injured body parts in detail, single leg shallow knee bend

### C. Tests available to the GP

1. DSST pre-season
2. Sport Concussion Assessment Tool after any head injury
3. ECG - Rhythm - sinus / atrial fibrillation, WPW, long QT syndrome to exclude some causes of sudden cardiac death, e.g. HOCM, arrhythmogenic right ventricular dysplasia
4. Respiratory function
  - a. Serial PFR
  - b. Spirometry
  - c. Bronchial provocation tests
5. Blood tests
  - a. CBC
  - b. Ferritin
  - c. CRP if recent illness
  - d. Urinalysis in Polynesian athletes or others at higher risk of renal disease

Chris Milne  
Sports Physician  
Hamilton  
June 2012

## 2. Digit symbol substitution test

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

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

Digit

Symbol

|   |   |   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| — | ⊥ | ┘ | └ | ⊏ | ○ | ∧ | × | = |

Score

|  |
|--|
|  |
|--|

|   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | 1 | 3 | 7 | 2 | 4 | 8 | 2 | 1 | 3 | 2 | 1 | 4 | 2 | 3 | 5 | 2 | 3 | 1 | 4 | 5 | 6 | 3 | 1 | 4 |
| ⊥ | — | ┘ | ∧ | ⊥ | └ | × |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |

|   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 5 | 4 | 2 | 7 | 6 | 3 | 5 | 7 | 2 | 8 | 5 | 4 | 6 | 3 | 7 | 2 | 5 | 1 | 9 | 5 | 8 | 4 | 7 | 3 |
|   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |

|   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6 | 2 | 5 | 1 | 9 | 2 | 8 | 3 | 7 | 4 | 6 | 5 | 9 | 4 | 8 | 3 | 7 | 2 | 6 | 1 | 5 | 4 | 6 | 3 | 7 |
|   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |

|   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 9 | 2 | 8 | 1 | 7 | 9 | 4 | 6 | 8 | 5 | 9 | 7 | 1 | 8 | 5 | 2 | 9 | 4 | 8 | 6 | 3 | 7 | 9 | 8 | 6 |
|   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |

Fig 10. The Digit Symbol Substitution Test (DSST). The athlete completes as many boxes as possible in 90 seconds.

|        |  |  |  |  |  |
|--------|--|--|--|--|--|
| Date:  |  |  |  |  |  |
| Score: |  |  |  |  |  |

## 3. Return to Play Criteria

1. No symptoms at rest
2. No symptoms with exercise
3. Return of DSST to pre-season baseline level
4. Clearance by a doctor

NB: Must satisfy all 4 criteria before can safely return to play.

## Patient Information Sheet

### CONCUSSION

#### 1. What is it?

It is a disturbance of brain function following head injury.

#### 2. What causes it?

It is caused by one or more blows to the head or transmitted shock from another part of the body.

#### 3. Symptoms – what you notice

- a. Loss of consciousness – you don't need to be knocked out to suffer concussion, but the longer you lose consciousness the more severe the head injury.
- b. In the first day after injury you may notice:  
Headache                                      Blurred vision  
Irritability                                      Memory loss  
Gait disturbance – unable to walk a straight line
- c. Over the next few days or weeks you may notice:  
Dizziness                                      Slow decision making (impaired cognition)  
Fatigue                                          Decreased concentration span

These are all symptoms of the post-concussion syndrome.

#### 4. Signs – what the doctor finds

- a. Decreased level of consciousness.
- b. Signs of local brain irritation (localising signs), e.g. weakness of one arm or leg.
- c. Poor short term memory.
- d. Decreased concentration span (e.g. digit span).
- e. Unsteady gait.

#### 5. Investigations

Unless there is evidence of a possible skull fracture, x-rays are not needed. If there is evidence of severe head injury, a CT or MRI scan may be necessary. The most useful test is the digit symbol substitution test (or DSST). This is a paper based assessment of speed of information processing. Ideally, there should be a pre-season baseline test with which to compare the post-concussion results. In recent years, computerised tests have been developed and are the most appropriate for professional athletes.

#### 6. Treatment

- a. Rest from all exercise until all symptoms resolve.
- b. Once you are free of symptoms you can progressively return to full training, starting with gentle aerobic exercise.
- c. If you can manage aerobic training without getting a headache or other symptoms, you can restart team training.
- d. If you can manage team training without symptoms, it is safe to restart playing.

#### 7. Recovery time

Average recovery time is about three weeks, which is the mandatory stand-down period in rugby. However, not all head injuries are the same, so you need to wait until symptoms have resolved.

#### 8. Recovery sequence

**Step 1** Resolution of all symptoms at rest.

**Step 2** Resolution of all symptoms with exercise.

**Step 3** Safe to return to play provided:

- a. Symptom free.
- b. Return of DSST/computerised tests to baseline (if available).
- c. Clearance by doctor.

# Pocket SCAT2



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.

## 1. Symptoms

Presence of any of the following signs & symptoms may suggest a concussion.

- Loss of consciousness
- Seizure or convulsion
- Amnesia
- Headache
- "Pressure in head"
- Neck Pain
- Nausea or vomiting
- Dizziness
- Blurred vision
- Balance problems
- Sensitivity to light
- Sensitivity to noise
- Feeling slowed down
- Feeling like "in a fog"
- "Don't feel right"
- Difficulty concentrating
- Difficulty remembering
- Fatigue or low energy
- Confusion
- Drowsiness
- More emotional
- Irritability
- Sadness
- Nervous or anxious

## 2. Memory function

( Maddocks questions)

Failure to answer all questions correctly may suggest a concussion.

*"At what venue are we at today?"*

*"Which half is it now?"*

*"Who scored last in this game?"*

*"What team did you play last week / game?"*

*"Did your team win the last game?"*

## 3. Balance testing

### Instructions for tandem stance

*"Now stand heel-to-toe with your **non-dominant** foot in back. Your weight should be evenly distributed across both feet. You should try to maintain stability for 20 seconds with your hands on your hips and your eyes closed. I will be counting the number of times you move out of this position. If you stumble out of this position, open your eyes and return to the start position and continue balancing. I will start timing when you are set and have closed your eyes."*

Observe the athlete for 20 seconds. If they make more than 5 errors (such as lift their hands off their hips; open their eyes; lift their forefoot or heel; step, stumble, or fall; or remain out of the start position for more than 5 seconds) then this may suggest a concussion.

**Any athlete with a suspected concussion should be IMMEDIATELY REMOVED FROM PLAY, urgently assessed medically, should not be left alone and should not drive a motor vehicle.**

## 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 \_\_\_\_\_

### What is the SCAT2?<sup>1</sup>

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 2005<sup>2</sup>. This tool also enables the calculation of the Standardized Assessment of Concussion (SAC)<sup>3,4</sup> score and the Maddocks questions<sup>5</sup> 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.

## Symptom Evaluation

### 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 (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)

Symptom severity score

(Add all scores in table, maximum possible: 22 x 6 = 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

# 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 |
| 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.

**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.

| 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     |
| <b>Total</b> |         |         |         |                       |

**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 7-1-9, you would say 9-1-7."*

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.

|             |     | Alternative digit lists             |
|-------------|-----|-------------------------------------|
| 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 |

**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

<sup>1</sup> This tool has been developed by a group of international experts at the 3<sup>rd</sup> 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.

<sup>2</sup> McCrory P et al. Summary and agreement statement of the 2<sup>nd</sup> International Conference on Concussion in Sport, Prague 2004. British Journal of Sports Medicine. 2005; 39: 196-204

<sup>3</sup> McCrea M. Standardized mental status testing of acute concussion. Clinical Journal of Sports Medicine. 2001; 11: 176-181

<sup>4</sup> McCrea M, Randolph C, Kelly J. Standardized Assessment of Concussion: Manual for administration, scoring and interpretation. Waukesha, Wisconsin, USA.

<sup>5</sup> Maddocks, DL; Dicker, GD; Saling, MM. The assessment of orientation following concussion in athletes. Clin J Sport Med. 1995;5(1):32-3

<sup>6</sup> Guskiewicz KM. Assessment of postural stability following sport-related concussion. Current Sports Medicine Reports. 2003; 2: 24-30

## Balance examination

This balance testing is based on a modified version of the Balance Error Scoring System (BESS)<sup>6</sup>. A stopwatch or watch with a second hand is required for this testing.

### Balance testing

"I am now going to test your balance. Please take your shoes off, roll up your pant legs above ankle (if applicable), and remove any ankle taping (if applicable). This test will consist of three twenty second tests with different stances."

#### (a) Double leg stance:

"The first stance is standing with your feet together with your hands on your hips and with your eyes closed. You should try to maintain stability in that position for 20 seconds. I will be counting the number of times you move out of this position. I will start timing when you are set and have closed your eyes."

#### (b) Single leg stance:

"If you were to kick a ball, which foot would you use? [This will be the dominant foot] Now stand on your non-dominant foot. The dominant leg should be held in approximately 30 degrees of hip flexion and 45 degrees of knee flexion. Again, you should try to maintain stability for 20 seconds with your hands on your hips and your eyes closed. I will be counting the number of times you move out of this position. If you stumble out of this position, open your eyes and return to the start position and continue balancing. I will start timing when you are set and have closed your eyes."

#### (c) Tandem stance:

"Now stand heel-to-toe with your non-dominant foot in back. Your weight should be evenly distributed across both feet. Again, you should try to maintain stability for 20 seconds with your hands on your hips and your eyes closed. I will be counting the number of times you move out of this position. If you stumble out of this position, open your eyes and return to the start position and continue balancing. I will start timing when you are set and have closed your eyes."

### 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

Each of the 20-second trials is scored by counting the errors, or deviations from the proper stance, accumulated by the athlete. The examiner will begin counting errors only after the individual has assumed the proper start position. **The modified BESS is calculated by adding one error point for each error during the three 20-second tests. The maximum total number of errors for any single condition is 10.** If a athlete commits multiple errors simultaneously, only one error is recorded but the athlete should quickly return to the testing position, and counting should resume once subject is set. Subjects that are unable to maintain the testing procedure for a minimum of **five seconds** at the start are assigned the highest possible score, ten, for that testing condition.

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

| Condition                                                | Total errors |
|----------------------------------------------------------|--------------|
| Double Leg Stance (feet together)                        | of 10        |
| Single leg stance (non-dominant foot)                    | of 10        |
| Tandem stance (non-dominant foot at back)                | of 10        |
| <b>Balance examination score</b> (30 minus total errors) | <b>of 30</b> |

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## Coordination examination

### Upper limb coordination

Finger-to-nose (FTN) task: "I am going to test your coordination now. Please sit comfortably on the chair with your eyes open and your arm (either right or left) outstretched (shoulder flexed to 90 degrees and elbow and fingers extended). When I give a start signal, I would like you to perform five successive finger to nose repetitions using your index finger to touch the tip of the nose as quickly and as accurately as possible."

Which arm was tested:      Left      Right

Scoring:      5 correct repetitions in < 4 seconds = 1

Note for testers: Athletes fail the test if they do not touch their nose, do not fully extend their elbow or do not perform five repetitions. Failure should be scored as 0.

Coordination score

of 1

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## Cognitive assessment

### Standardized Assessment of Concussion (SAC)

#### Delayed recall

"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."

Circle each word correctly recalled. Total score equals number of words recalled.

| List   | Alternative word list |         |         |
|--------|-----------------------|---------|---------|
| elbow  | candle                | baby    | finger  |
| apple  | paper                 | monkey  | penny   |
| carpet | sugar                 | perfume | blanket |
| saddle | sandwich              | sunset  | lemon   |
| bubble | wagon                 | iron    | insect  |

Delayed recall score

of 5

## Overall score

| Test domain                    | Score         |
|--------------------------------|---------------|
| Symptom score                  | of 22         |
| Physical signs score           | of 2          |
| Glasgow Coma score (E + V + M) | of 15         |
| Balance examination score      | of 30         |
| Coordination score             | of 1          |
| <b>Subtotal</b>                | <b>of 70</b>  |
| Orientation score              | of 5          |
| Immediate memory score         | of 5          |
| Concentration score            | of 15         |
| Delayed recall score           | of 5          |
| <b>SAC subtotal</b>            | <b>of 30</b>  |
| <b>SCAT2 total</b>             | <b>of 100</b> |
| <b>Maddocks Score</b>          | <b>of 5</b>   |

Definitive normative data for a SCAT2 "cut-off" score is not available at this time and will be developed in prospective studies. Embedded within the SCAT2 is the SAC score that can be utilized separately in concussion management. The scoring system also takes on particular clinical significance during serial assessment where it can be used to document either a decline or an improvement in neurological functioning.

Scoring data from the SCAT2 or SAC 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.

# Athlete Information

Any athlete suspected of having a concussion should be removed from play, and then seek medical evaluation.

## Signs to watch for

Problems could arise over the first 24-48 hours. You should not be left alone and must go to a hospital at once if you:

- Have a headache that gets worse
- Are very drowsy or can't be awakened (woken up)
- Can't recognize people or places
- Have repeated vomiting
- Behave unusually or seem confused; are very irritable
- Have seizures (arms and legs jerk uncontrollably)
- Have weak or numb arms or legs
- Are unsteady on your feet; have slurred speech

**Remember, it is better to be safe.**

**Consult your doctor after a suspected concussion.**

## Return to play

Athletes should not be returned to play the same day of injury.

When returning athletes to play, they should follow a stepwise symptom-limited program, with stages of progression. For example:

1. rest until asymptomatic (physical and mental rest)
2. light aerobic exercise (e.g. stationary cycle)
3. sport-specific exercise
4. non-contact training drills (start light resistance training)
5. full contact training after medical clearance
6. return to competition (game play)

There should be approximately 24 hours (or longer) for each stage and the athlete should return to stage 1 if symptoms recur. Resistance training should only be added in the later stages.

**Medical clearance should be given before return to play.**

| Tool                                      | Test domain                    | Time             | Score |
|-------------------------------------------|--------------------------------|------------------|-------|
|                                           |                                | Date tested      |       |
|                                           |                                | Days post injury |       |
|                                           | Symptom score                  |                  |       |
|                                           | Physical signs score           |                  |       |
|                                           | Glasgow Coma score (E + V + M) |                  |       |
| SCAT2                                     | Balance examination score      |                  |       |
|                                           | Coordination score             |                  |       |
|                                           | Orientation score              |                  |       |
|                                           | Immediate memory score         |                  |       |
| SAC                                       | Concentration score            |                  |       |
|                                           | Delayed recall score           |                  |       |
|                                           | SAC Score                      |                  |       |
| Total                                     | SCAT2                          |                  |       |
| Symptom severity score (max possible 132) |                                |                  |       |
| Return to play                            |                                | Y N Y N Y N Y N  |       |

Additional comments

## Concussion injury advice (To be given to concussed athlete)

This patient has received an injury to the head. A careful medical examination has been carried out and no sign of any serious complications has been found. It is expected that recovery will be rapid, but the patient will need monitoring for a further period by a responsible adult. Your treating physician will provide guidance as to this timeframe.

**If you notice any change in behaviour, vomiting, dizziness, worsening headache, double vision or excessive drowsiness, please telephone the clinic or the nearest hospital emergency department immediately.**

**Other important points:**

- Rest and avoid strenuous activity for at least 24 hours
- No alcohol
- No sleeping tablets
- Use paracetamol or codeine for headache. Do not use aspirin or anti-inflammatory medication
- Do not drive until medically cleared
- Do not train or play sport until medically cleared

Patient's name

Date/time of injury

Date/time of medical review

Treating physician

Clinic phone number

Contact details or stamp