

# Sport and exercise medicine

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## Abstract

Since it was granted formal specialty status in 2006, sport and exercise medicine (SEM) has continued to grow and flourish. With an increasing body of specialists and trainees, clinical practice, research and consensus are growing and evolving, striving to offer timely and evidence-based care. Lessons learnt and new frontiers broached in elite sport are increasingly being translated to benefit patients, and vice versa. With physical activity at its core, the specialty is exceptionally diverse and truly multidisciplinary, drawing on the skill sets of doctors and allied health professionals alike. Current hot topics, some of which are discussed in this article, are equally varied, affecting both active and inactive individuals. The evidence pool in exercise medicine continues to build exponentially, making an ever more compelling case for all healthcare providers to be well practised in incorporating physical activity into holistic and effective management plans for all their patients.

**Keywords** Concussion; consensus; exercise; groin pain; medicine; muscle injury; relative energy deficiency; sport; tendinopathy

## Introduction

Sport and exercise medicine (SEM) is growing, with an increasing number of specialists providing evidence-based, clinically reasoned expertise for all, from the general public through to elite athletes. Through working with and leading multidisciplinary teams comprising allied health professionals, the essence of promoting physical activity is central to the prevention and management of most chronic diseases to effectively reduce morbidity, mortality and economic burden. In addition, it helps

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## Key points

- The evidence base and consensus are building and evolving as a result of the growth of sport and exercise medicine (SEM) since specialty status was granted
- Lessons and evidence from elite sport can be translated to all patients suffering similar conditions
- Patients who are failing to improve or reach their goals should be referred to an SEM service or established subspecialty clinics, for example on concussion or tendinopathy, where available
- All healthcare professionals should ask their patients about their physical activity levels and invariably encourage a little more activity as appropriate

regular exercisers and elite athletes to remain active and achieve their performance goals.

Level one research involving the elite athlete population is challenging, not least because of small sample sizes, logistical barriers and ethical considerations. Increasingly, however, governing bodies and medical teams are recognizing the importance of systematically studying treatments and outcomes to further their goals, which in turn can translate to the general population; the British Athletics Muscle Injury Classification is one such example.

Subspecialty clinics, such as for concussion and tendinopathy, are also available, providing patients with clinical expertise while enabling the exploration of condition phenotypes, mechanisms and outcomes; these then translate to improving care for patients including athletes. An increasing number of expert consensus statements consider the best available evidence from athletic and non-athletic populations, such as for sports concussion, athletic groin pain and relative energy deficiency in sport (RED-S), that are helpful for informing practice.

## Sport-related concussion

Concussion is a functional neurological disturbance, caused by a blow to the head or body, in which the brain is impacted within the skull. This results in neurophysiological changes, including neurotransmitter release, unchecked ionic fluxes and decreases in cerebral blood flow and glucose supply, triggering a cellular energy crisis. Neuronal dysfunction and cell death can ensue.

It is diagnosed clinically, and a high index of suspicion is required as the signs and symptoms are non-specific (Table 1). Loss of consciousness occurs in <15% of cases. Features can be delayed as a concussion evolves, requiring close observation. In sport, the validated Sport Concussion Assessment Tool (SCAT; <http://bjsm.bmj.co/content/early/2017/04/26/bjsports-2017-097506SCAT5>) is commonly used to facilitate the diagnosis and objective monitoring of concussion. However, there is a learning effect from repeated use of this instrument, and some players downplay symptoms in order to continue play, so clinical

acumen is key. Digital neurocognitive tests are also available, aiming to detect subtle changes from baseline performance. However, promising research into a saliva test for selective fluid biomarkers released following a concussive injury may supersede these.<sup>1</sup>

If concussion is suspected on clinical grounds or from the observed mechanism, *either in real time or on video playback*, the individual must be immediately removed from play and not return that day. Players with a reduced level of consciousness should be treated as having a neck injury, irrespective of neck pain, and not moved.

National Institute for Health and Care Excellence (NICE) guidelines advise on the indications for computed tomography of the head to exclude haemorrhagic brain injury (NICE Head Injury Assessment and Early Management, 2017-<https://www.nice.org.uk/guidance/cg176>). Although concussion is associated with an absence of abnormalities on clinical radiology, advanced neuro-imaging techniques have demonstrated changes in brain structure and function. These correlate with post-concussive symptoms and performance in neurocognitive testing during the acute post-injury phase.

There is an individual variable impact threshold for suffering concussion and for the severity and duration of symptoms. Children and women are more prone to longer post-concussive episodes, and the *APOE E4* gene has been linked to susceptibility to concussion.<sup>2</sup>

Following a single concussion, a player's impact threshold appears to reduce so they can subsequently sustain a concussion in a collision where most players would not be affected; they are also more prone to other injuries. Symptom severity and duration

increase with each concussion. Following a second concussion in a single season, an athlete should see a doctor with expertise in concussion.

'Complex concussion' services are beginning to appear and should be sought (e.g. at the Institute of Sport Exercise and Health). They can be especially useful for prolonged symptoms that preclude a safe return to sport or work. Differential diagnoses such as headaches caused by migraines or referred pain from the neck, and oculo-vestibular deficits, can be excluded and managed appropriately, and advanced neuro-imaging can be performed. Long-term sequelae of repeated concussions, such as possible cognitive decline and reported links with chronic traumatic encephalopathy, can also be considered.

The mainstay of management currently advocates rest from all exercise and activities that require concentration and that increase symptoms. Time off work or school can be required. Once the symptoms have resolved, athletes can take part in activities of daily living and light exercise, as long as these do not bring on symptoms. A graduated return to play (GRTP) protocol should be followed to gradually test the brain's response to increasing heart rate, coordination and cognitive load, to ensure full recovery has occurred. For most adults, a 2-week relative rest period is required before further medical review to ensure that symptoms of concussion have resolved.

Table 2 illustrates an example of a GRTP protocol, noting the extra time allowed for recovery of the young and developing brain. Patients must be symptom-free at each stage before progressing to the next. In elite sport where there is daily monitoring of adult players by experienced medical practitioners, an enhanced care pathway can be followed, if certain stipulations are met, in which athletes may require only a 24-hour rest period before starting the GRTP.

### Signs and symptoms of concussion

- Actual or suspected loss of consciousness
- Convulsions or posturing
- Loss of coordination/balance
- Vomiting
- Confusion
- Memory loss
- Dazed appearance
- Nausea
- Drowsiness
- Irritability
- Emotional display
- Fatigue/low energy
- Anxiety/nervousness
- Poor memory
- Neck pain
- Headache/'pressure' in head
- Dizziness
- Blurred vision
- Sensitivity to light or noise
- Difficulty concentrating
- 'Feeling in a fog'
- 'Don't feel right' — do they feel how they would normally expect to feel at this time in a game?

Table 1

### Relative energy deficiency in sport

Formerly referred to as the 'female athlete triad', the term 'RED-S' was coined following an International Olympic Committee (IOC) expert consensus meeting in 2014 acknowledging its broader health consequences and potential impact on performance.

In this condition, the individual's dietary intake is insufficient to support the energy expenditure required for health and function after exercise and sporting activity have been fuelled. Physiological impairments, for example of metabolic rate, immunity, protein synthesis and bone and cardiovascular health, are not gender-specific, but the resulting impact can be, given differing basal requirements, hormone profiles and psychology. Performance is reduced because of a combination of physical effects, such as decreases in muscle strength and coordination, and psychological effects, including poor concentration and impaired judgement. This culminates in increased risk of injury. The length of time an athlete can experience energy deficiency without compromise to their health or performance is variable and individual.

The regular exerciser can present with variable, subtle and non-specific symptoms, such as underperformance and fatigue, frequent injury or recurrent illness, mood changes or weight loss. Anxiety and depression can be more marked in an individual with RED-S. Insufficient calorie intake can result from a miscalculation of dietary requirements or from unusual eating habits,

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