Article

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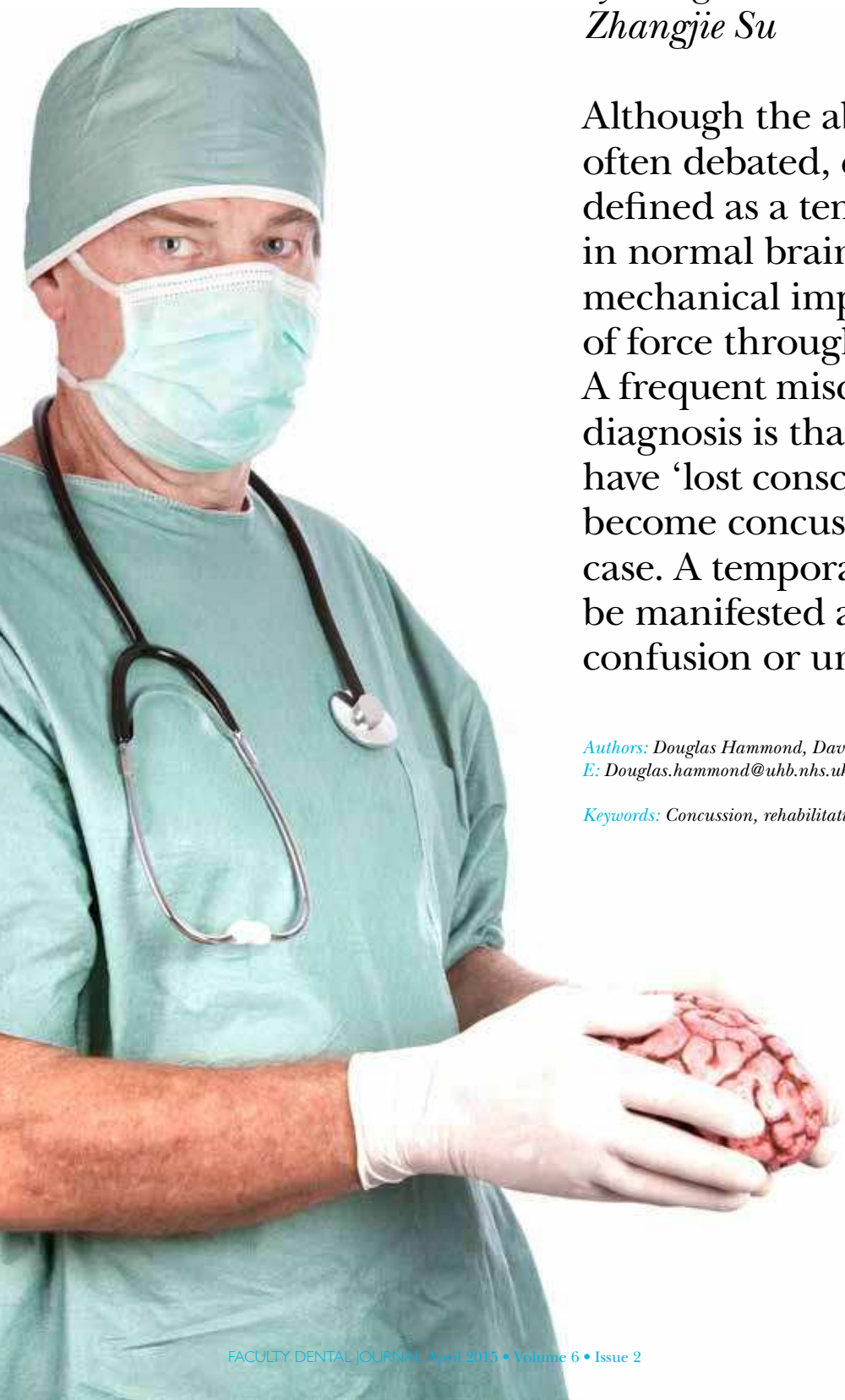
Do we forget to treat concussion?

by Douglas Hammond, David Davies, Zhangjie Su



Although the absolute definition is often debated, concussion can be defined as a temporary disruption in normal brain function after a mechanical impact or transmission of force through cerebral tissue. A frequent misconception in the diagnosis is that an individual must have 'lost consciousness' to have become concussed; this is not the case. A temporary loss of function may be manifested as blurring of vision, confusion or unsteadiness.

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Concussion is a complex neurometabolic condition, and diagnosis relies on the assessment of patient symptoms, cognitive function and motor function. There are diagnostic tests available for concussion but there is neither one conclusive diagnostic test nor consensus about the reliability of the diagnostic tests available.[1]

Why is concussion relevant to dentistry?

While on call in DF[2] and CT1 posts that have either a partial or complete working time commitment to oral and maxillofacial surgery, you will see patients who have sustained injuries to their maxillofacial skeleton. Undoubtedly, as part of your assessment, you will have patients who have sustained a concussive injury and/or lost consciousness. In the US, 1.7 million people sustain a traumatic brain injury every year.[2] Of these, 1.4 million are treated and released from an emergency department.

As dentists and doctors, we are conscientious about the management of our patients but we tend to gravitate towards injuries that we can see visually and, as such, we are extremely poor at managing concussion. The resolution of both the cognitive and clinical symptoms tends to follow a sequential course. In 80–90% of episodes of concussion, this resolves within 10 days,[3] leaving 10–20% of patients who have a longer recovery period. Despite this, patients who have had a concussive episode are rarely followed up.

Some principles of assessment

Patients who attend the emergency department with a head injury must be assessed initially according to the ABCDE (airway, breathing, circulation, disability, exposure) principles. Once serious injury has been ruled out, the important issues are:

- *Mechanism of injury*: A concussion can occur either from a direct blow to the head or as a result of an impulsive force that has been transmitted from elsewhere in the body to the head.
- *Loss of consciousness*: Frequently, concussion is associated with loss of consciousness. However, this is not always the case.
- *Presence of traumatic amnesia*: This is an established indicator of traumatic brain injury severity.[4]
- *Assessment of the clinical status of the patient*: This is extremely important. Has the patient improved or deteriorated since the injury? This may involve seeking information from people who witnessed the incident.

Signs and symptoms

A clinical assessment of the patient's cognitive status, functioning and balance is essential. If you are concerned about the patient having a significant injury (and this is beyond your capabilities), do not delay in seeking more specialised assistance. The signs and symptoms that may be exhibited are:

- *Signs*: vacant expression, gait unsteadiness, vomiting, irritability
- *Symptoms*: headache/foggy sensation
- *Cognitive impairment*: slowed reaction time, confusion, disorientation, inattention and amnesia.

If there is concern about the patient and the National Institute for Health and Care Excellence guidelines for computed tomography (CT) for head injury are met,[5] proceed to imaging. A tool that may also assist your clinical assessment of the patient is the SCAT3™ (Sport Concussion Assessment Tool).[6] This is a form that is downloadable from the internet and has been designed specifically for assessment of concussion in a sport context. However, the background, symptom evaluation, cognitive and physical evaluation elements in the form are excellent for providing a baseline assessment of the patient, and it is a reproducible examination that can be performed at follow-up to quantify improvement or lack thereof.

Special investigations?

Normally, patients with isolated concussion will not require any special investigations. Nevertheless, if persistent or concerning symptoms exist, then unenhanced CT of the head is required. In the majority of cases of classical concussion, where a temporary impediment of neurological function exists, CT of the head is not indicated. There are, however, certain circumstances where this investigation is required. (Details are highlighted later in this review.)

Unenhanced plain CT has been demonstrated to be the investigation of choice for imaging acute traumatic brain injury, with superior sensitivity to fresh blood over magnetic resonance imaging. It also has the additional benefits of a shorter imaging time, reduced cost and better widespread availability out of hours.

The role of the skull x-ray has been largely superseded in acute adult head injury. There are currently few clinical scenarios where a plain film x-ray of the skull would be indicated and CT would not. In these cases, the acquirement of CT of the brain negates the need for a plain film x-ray of the skull.

Management

In the UK, as a result of interpersonal violence, 52 in 100,000 patients per year will experience a traumatic brain injury[7] and in 2009 248,418 people were reported to have had a sport or recreation-related concussion in the US.[8] This shows that the main two causes of concussion are either interpersonal violence or sports-related injury. There are common elements to the rehabilitation for both of these groups. However, there is specific advice with regard to those who wish to return to playing sport.

General principles

The key principle in assessing the generally concussed individual is to establish that the likelihood of a structural neurological injury or intracranial mass lesion is acceptably low. This is done by taking a careful history and performing a focused clinical examination.

Guidelines published by the National Institute for Health Research suggest that any individual who

Rehabilitation stage	Functional exercise at each stage
Rest	Symptom limited and physical cognitive rest
Light aerobic activity	Exercise of less than 70% maximum permitted heart rate. No resistance training.
Sport specific activity	Running drills. Sprinting training.
Non-contact training drills	Progression to more complex training (eg passing drills). May start resistance training.
Full-contact training drills	Participation in normal activities
Return to play	Normal game play

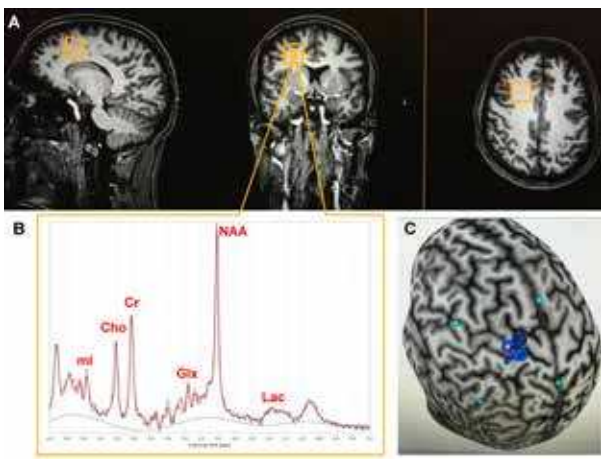
Table 1 The stepwise rehabilitation of a sportsperson following concussion[1]

sustains an injury to the head and exhibits the following features is in need of unenhanced CT of the brain:

- Glasgow coma scale (GCS) score of <13 on initial assessment in the emergency department
- GCS <15 at 2 hours after the injury, on assessment in the emergency department
- suspected open or depressed skull fracture
- any sign of basal skull fracture such as haemotympanum, 'panda eyes', cerebrospinal fluid leakage from the nose or ear, Battle's sign
- post-traumatic seizure
- focal neurological deficit
- more than one episode of vomiting.

Additional guidance was set stating that should this imaging be undertaken, a radiological report should be available within one hour of image acquirement. This is an important aspect of management in the general secondary care environment, where specialist neurological or neurosurgical input may not be available.

Figure 1



If none of the criteria for the requirement of CT are fulfilled or if CT is undertaken and displays abnormality, then the injury can be treated conservatively. The key facets of this should include a socially safe discharge, with a competent adult to supervise the patient for at least 24 hours. If a socially safe discharge is not possible owing to intoxication, home circumstances or lack of competent supervision, an overnight inpatient stay for observation should be considered. If discharge is possible, then a comprehensive and written set of instructions should be given to both the patient and the accompanying responsible adult. This should also be documented clearly in the patient's medical notes. The conservative advice should be:[6]

- Rest both physically and mentally until your symptoms have resolved and you are cleared medically
- No alcohol
- No sleeping tablets
- Do not use anti-inflammatory medication or sedating pain killers
- Do not train or play sport until cleared medically.

Evolving signs and symptoms to look out for, which may necessitate seeking medical advice:

- a worsening headache
- increased drowsiness
- repeated vomiting
- marked irritability
- seizure
- limb weakness or unsteady gait
- visual disturbance.

Should CT be undertaken and indicate an abnormality (as documented on the imaging report), then a referral to specialist trauma services is recommended, and discharge from the secondary care setting should not be undertaken without consultation and management planning by specialist clinicians (trauma or neurosurgical services).

Sports-specific rehabilitation

The general guidance on sport-related rehabilitation is that there should be an initial period of 48 hours' rest followed by what is described as a graduated return to play.[1] The patient should be cleared after a SCAT3™ assessment[6] and be allowed to recommence physical activity. Patients must follow a stepwise approach (Table 1) if asymptomatic at their present level. Each step should as a rule take 24 hours so that an athlete would take approximately 1 week to proceed through the full rehabilitation protocol after he or she is asymptomatic at rest and with progressive exercise tolerance. If any of the concussion-type symptoms return while in the stepwise programme, the patient should return to the level at which he or she had been asymptomatic previously and aim to progress again after a further rest period of 24 hours.

With regard to children, they have a different physiological response to concussion[9] and have specific risks such as diffuse cerebral swelling.[1] Consequently, a more

conservative return to sport is recommended. The only specific guidance on time is given by the Rugby Football Union on its website,[10] which recommends a break of at least 23 days for children compared with 6–19 days for adults, depending on whether they are under the care of a physician who is experienced in the management of concussion.

The persistently symptomatic concussed patient

Persistent postconcussion symptoms in an uncomplicated case of mild traumatic brain injury (concussion) without abnormalities on CT are uncommon.[11] However, in certain cases, especially those with recurrent injuries, the presence of persistent (>4 weeks) postconcussion symptoms may be encountered. In cases of persistent postconcussion syndrome, symptoms can be frequently pervasive and concerning to the individual, with headaches and impaired processing speed impacting markedly on individuals.

Recent evidence suggests that postconcussion symptoms are related, and so are a number of subtle biochemical and structural abnormalities in the brain.[12] The primary means of observation of these abnormalities and imbalances is via high-resolution magnetic resonance spectroscopy and diffusion tensor imaging. These imaging modalities allow the quantification of certain neurologically important substances such as choline, lactate, N-acetylaspartate and glutamate, alongside information regarding the complex filamentous conformation of the white matter tract paths. Imbalances and abnormalities in these are thought to correlate with and represent an organic basis to the postconcussion syndrome. It is, however, uncertain as to the degree in which these abnormalities predict outcome.

Management of the persistently or recurrently concussed patient

Managing patients with recurrent concussion is difficult as there is no great evidence base and most recommendations are anecdotal.[13] Nevertheless, there is the potential for medicolegal problems if these patients are not treated in conjunction with the aid of physicians from allied specialties such as neurosurgeons or neurologists. However, there is growing evidence that recurrent concussion may have implications for deterioration in mental function in later life.[14]

In most cases, specialist review is indicated, via a referral to an appropriate multidisciplinary clinic. These frequently comprise a consultant neurosurgeon, a neuropsychologist and specialist nursing staff. The existence of symptoms is speculated to be directly representative of abnormalities in brain architecture and biochemistry as discussed above; furthermore, these are believed to indicate a window of vulnerability to augmented injury following any further trauma to the brain.[15] For that reason, a cornerstone of management is avoidance of any further injury and, on occasion, this may lead to an individual being advised to abstain from a certain activity for a protracted time (until he or she is completely asymptomatic and investigations prove completely normal). Occasionally, an individual may be advised to abstain permanently from a certain activity as the risk of cumulative damage and long-term neurological impediment is deemed too great.

Conclusions

Concussion is a condition that we treat incredibly badly. Most patients who have received a head injury and attended the emergency department will have been questioned about loss of consciousness. However, unless there is a clear and obvious moderate or severe brain injury, they will receive no further treatment or even advice with regard to it. There is a growing body of evidence[14] that by not managing concussion (especially in sportsmen and sportswomen), this may have an impact on their cerebral function in their later years.

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