Rehabilitation of Acute Head and Facial Injuries

Paul McCrory[1,2], Peter D. le Roux[3], Michael Turner[4], Ingunn R. Kirkeby[5], and Karen M. Johnston[6]

[1]*University of Melbourne, Melbourne, VIC, Australia*
[2]*Monash University, Frankston, VIC, Australia*
[3]*University of Pennsylvania, Philadelphia, PA, USA*
[4]*British Horseracing Authority, London, UK*
[5]*Oslo University Hospital, Rikshospitalet, Sognsveien, Oslo, Norway*
[6]*University of Toronto, Toronto, ON, Canada*

Goals and Principles

Table 4.7 lists the goals for rehabilitation of acute head and facial injuries.

The functional outcome in patients who have sustained an acute head injury varies greatly. Fortunately in sport most injuries are mild and recover rapidly without any lasting sequelae. In contrast, moderate and severe traumatic brain injuries have a variable and unpredictable outcome. Lasting problems include both mental (such as personality changes and memory deficit) and physical (such as hemiparesis and speech disturbance).

The goal of rehabilitation of patients with severe head injuries is to get the patient back to a level of function in which he is as independent of others as possible. In the best case, the patient will return to the level he was at before the injury. In principle, rehabilitation of patients with serious head injuries begins at the hospital immediately after the injury or operation. Most rehabilitation occurs during the first 6 months after the injury, but it is not until a year later that there is any degree of certainty about which level the patient will attain. However, the rehabilitation potential of many patients extends beyond one year. Physical therapy and occupational therapy are not only vital in reducing contractures and improving strength in the extremities, but also for stimulating the patient's own motivation.

	Goals	Measures
Phase 1	Prevent secondary brain damage	Acute treatment at the proper level of care
Phase 2	Mobilization and regaining primary functions	Practical help from physical and occupational therapists
Phase 3	Complete recovery of lost functions	Specialized rehabilitation program

Table 4.7 Goals and measures for rehabilitation of head injuries. (Reproduced with permission from the Norwegian Sports Medicine Association.)

Return to Sport

Concussion

Return to play decisions remains difficult. Expert consensus guidelines recommend that players should *not* be returned to competition until they have recovered *completely* from their concussive injury. Currently, however there is no single gold standard measure of brain disturbance and recovery following concussion. Instead, clinicians must rely on indirect measures to inform clinical judgment. In practical terms, this involves a multifaceted clinical approach, which includes assessment of symptoms, physical signs (such as balance) and cognitive function.

The general management principle is that no return to play on the day should be contemplated for a concussed athlete. It is not within the scope or expertise of a physiotherapist, trainer or non-medical person to manage a concussive injury or determine the timing of return to play. A player should never return to play while symptomatic. "When in doubt, sit them out!"

The cornerstone of concussion management is physical and cognitive rest until symptoms resolve and then a graded program of exertion prior to medical clearance and return to play (see "Concussion injury advice" page 4 of SCAT2 form; Figure 4.2). Similarly, the use of alcohol, narcotic analgesics, anti-inflammatory medication or sedatives can exacerbate symptoms following head trauma, delay recovery or mask deterioration and should also be avoided. Specific advice should also be given on avoidance of activities that place the individual at risk of further injury (e.g., driving).

Following a concussive injury, players should be returned to play in a graduated fashion once clinical features have resolved and cognitive function returned to "baseline." When considering return to play, the athlete should be off all medications at the time of considering commencement of the rehabilitation phase or at the final medical assessment. There is no mandatory period of time that a player must be withheld from play following a concussion. However, at the very minimum, a player must be symptom free at rest and with exertion, and determined to have returned to baseline level of cognitive performance. A stepwise Graduated Return to Play Protocol is recommended (Table 4.8).

Rehabilitation stage	Functional exercise at each stage of rehabilitation	Objective at each stage
1. No activity	Complete physical and cognitive rest	Recovery
2. Light aerobic exercise	Walking, swimming or stationary cycling keeping intensity <70% HR max. No resistance training.	Increase heart rate
3. Sport-specific exercise	Skating drills in ice hockey, running drills in soccer. No head impact activities.	Add movement.
4. Noncontact training drills	Progression to more complex training drills, for example, passing drills in hockey and football.	Exercise, coordination and cognitive load
5. Full contact practice	Following medical clearance participate in normal training activities	Restore confidence and assess functional skills by coaching staff
6. Return to play	Normal game play	

Table 4.8 Graduated return to play protocol. (Reproduced with permission from the Norwegian Sports Medicine Association.)

If a player remains asymptomatic for 24 hours at level 1, they may progress to level 2. They are allowed to advance provided that they remain asymptomatic. Using this protocol, an athlete should take approximately a week before returning to normal game play. If any symptoms surface during the progression, players should drop back to the previous level in which they were asymptomatic for a further 24 hours before attempting to progress.

A player who has suffered from a concussive injury must not be allowed to return to play before having a medical clearance. In every case, the decision regarding the timing of return to training should be made by a medical doctor with experience in concussive injuries.

Children younger than 10-year-old report different symptoms, so age and developmentally appropriate evaluation is recommended. An additional consideration in assessing the child or adolescent athlete with a concussion is that in the clinical evaluation by the healthcare professional there may be the need to include both patient and parent input as well as teacher and school input when appropriate. Children should not be returned to practice or play until clinically completely symptom free, which may require a longer time frame than for adults. In addition, the concept of "cognitive rest" is highlighted with special reference to a child's need to limit exertion with activities of daily living and to limit scholastic and other cognitive stressors (e.g., text messaging, videogames) while symptomatic. School attendance and activities may also need to be modified to avoid provocation of symptoms.

Screening computerized cognitive tests are strongly encouraged in the routine management of concussion in sport. Computerized tests provide a quick, valid and reliable measure of cognitive recovery following a concussive injury. These include test platforms such as Axon CCST (www.axonsports.com), ImPACT (www.impact-test.com), Headminders (www.headminders.com), and a tool developed by the US military–Automated Neuropsychological Assessment Metrics (www.armymedicine.army.mil/prr/anam.html). Overall, it is important to remember that neuropsychological testing is only one component of assessment, and, therefore, should not be the sole basis of management decisions.

Catastrophic or Severe Head Injury

Return to sport following a severe or potentially life threatening brain injury is controversial and few guidelines exist for the clinician to follow. There are some situations where the athlete could place himself at an unacceptably high risk of sustaining further injury and hence should be counseled against participation in collision sport (Table 4.9). In such situations, common sense should prevail.

- Persistent postconcussional or postinjury symptoms
- Permanent neurological sequelae—hemiplegia, visual deficit, dementia or cognitive impairment
- Hydrocephalus with or without shunting
- Spontaneous subarachnoid hemorrhage from any cause
- Symptomatic neurologic or pain producing abnormalities about the foramen magnum
- Craniotomy for evacuation of intracerebral or subdural hematoma

Table 4.9 Conditions contraindicating return to contact sport. (Reproduced with permission from the Norwegian Sports Medicine Association.)

Although sports physicians should keep an open mind when assessing neurological recovery from severe brain injuries nevertheless it is recommended that at least 12 months pass before such a decision is contemplated.

Thoughtful deliberation and analysis of all the available medical evidence should occur when making such a decision. It is also recommended that the counsel of a neurologist or neurosurgeon experienced in sport head injury management be sought. This is an important point because a number of individuals who suffer a moderate to severe TBI may be left with a lack of insight and impaired judgment over and above their other neurological injuries. This in turn may make such an individual unreliable in gauging recovery. The use of neuropsychological assessment as well as information from family and friends may assist the clinician in his deliberation. The assessment of cognitive performance and/or clinical symptoms when fatigued is often useful.

Return to collision sport is relatively contraindicated in almost any situation where surgical craniotomy is performed. In such situations, the subarachnoid space is traumatized thus setting up scarring of the pia-arachnoid of the brain to the dura with both loss of the normal cushioning effect of the CSF and vascular adhesions that may subsequently bleed if torn during head impact. Even if neurologic recovery is complete, a craniotomy for anything other than an extradural hematoma effectively precludes return to collision sport.

With an extradural hematoma without brain injury or other condition where surgery is not required, return to sport may be contemplated in selected cases as per the discussion in the preceding text after a minimum of 12 months assuming neurologic recover is complete.

Soft-tissue Injuries

In most cases, athletes with grazes and contusions may begin training and participate in competition shortly after the injury occurs. For cuts and extensive soft-tissue injuries with tissue loss, the practitioner must tape sutured wounds for support or protection, so that healing is not interfered with to avoid scarring. In some cases this means that the athlete must continue to take it easy until after the sutures have been removed, normally 7 days postoperatively.

Abrations should be treated with sterile ointment during the healing period, which may be for several weeks. Compression of lacerations for several weeks may reduce scarring. Meticulous initial reconstructive soft tissue surgery reduces scar formation. Revision procedures should be delayed for at least 3 months, as scars usually (may) improve over time.

Dentoalveolar Injuries

All tooth injuries that result in loosening of one or more teeth or tooth-bearing fragments require dental fixation with an arch bar. The bar is used for 1 week for luxated teeth without alveolar fractures, for 4 weeks for subluxated teeth with alveolar fractures, and for 8 weeks for root fractures. During that period, the athlete may train and compete in sports, except for martial arts and other sports where blows to the mouth and face occur. Consideration of the use of a mouthguard with improved dental protection is worthwhile. An example of this would be a custom-moulded laminated guard with or without a hard inset anteriorly depending upon the sport involved.

Fractures of the Facial Skeleton

All facial fractures take 4–6 weeks to heal. The question of whether the athlete may train or compete depends entirely on the extent of the injury and must be evaluated in every single case. In most cases, light training is possible as early as 1 week after the injury. In some cases, the athlete may participate in the sport only if he wears a special protective face mask. In most cases, the athlete is not able to compete until 3–4 weeks later.

Preventing Reinjury

It has become a widely held belief that having sustained a concussive injury, that one is then more prone to future concussive injury. The evidence for this contention is limited at best. It would seem obvious that in any collision or contact sport the risk of concussion is directly proportional to the amount of time playing the sport. Therefore the likelihood of repeat injury may simply reflect the level of exposure to injury risk. The association of an increased risk of subsequent concussions reported in players with a past history of concussion is thought to reflect a player's style of play where his risk of injury may be increased by utilizing dangerous game strategies and illegal tackling techniques.

When assessing an injured player, details regarding protective equipment employed at time of injury should be sought. The benefit of this approach allows for modification and optimization of protective behavior and an opportunity for head injury education. There are relatively few methods by which brain injury may be minimized in sport. The brain is not an organ that can be conditioned to withstand injury. Thus, extrinsic mechanisms of injury prevention must be sought.

There is no good clinical evidence that currently available protective equipment will prevent concussion although mouthguards have a definite role in preventing dental and oro-facial injury. Biomechanical studies have shown a reduction in impact forces to the brain with the use of head gear and helmets. For skiing and snowboarding there are a number of studies to suggest that helmets provide protection against head and facial injury and hence should be recommended for participants in alpine sports. In specific sports such as cycling, motor and equestrian sports, protective helmets may prevent other forms of head injury (e.g., skull fracture) that are related to falling on hard road surfaces and these may be an important injury prevention issue for those sports.

Neck muscle conditioning may be of value in reducing impact forces transmitted to the brain. Biomechanical concepts dictate that the energy from an impacting object is dispersed over the greater mass of an athlete if the head is held rigidly. Although attractive from a theoretical standpoint, there is little scientific evidence to demonstrate the effectiveness of such measures.

The major concern with the recommendation for helmet use in sport is the phenomenon known as "risk compensation," whereby helmeted athletes change their playing behavior in the misguided belief that the protective equipment will stop all injury. This is where the use of protective equipment results in behavioral change such as the adoption of more dangerous playing techniques, which can result in a paradoxical increase in injury rates. This may be a particular concern in child and adolescent athletes where head injury rates are often higher than in adult athletes.

As the ability to treat or reduce the effects of concussive injury after the event is minimal, education of athletes, colleagues and those working with them as well as the general public is a mainstay of progress in this field. Athletes and their health care providers must be educated regarding the detection of concussion, its clinical features, assessment techniques and principles of safe return to play. Methods to improve education including various web-based resources (e.g., www.concussionsafety.com), educational videos, outreach programs, concussion working groups and the support and endorsement of enlightened sport groups must be pursued vigorously.