Manejo clínico de la conmoción cerebral relacionada con el deporte en adolescentes y adultos

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Todos los temas se actualizan a medida que hay nueva evidencia disponible y nuestro proceso de revisión por pares se completa.

Revisión de la literatura vigente hasta: **agosto de 2023.**
Este tema se actualizó por última vez: **05 de septiembre de 2023.**

INTRODUCCIÓN

La preocupación por los efectos de una lesión cerebral traumática leve o conmoción cerebral sufrida durante el deporte ha aumentado sustancialmente en las últimas décadas. Si bien los efectos de las conmociones cerebrales relacionadas con el deporte (CRS) suelen ser benignos y autolimitados, pueden producirse secuelas graves a largo plazo y se necesita una evaluación cuidadosa.

Este tema revisa el manejo de adolescentes mayores y adultos que han sufrido una conmoción cerebral mientras participaban en deportes y cuya evaluación médica inicial no revela **signos** de otra lesión importante, como hemorragia intracraneal, fractura de cráneo o lesión de la columna cervical. La evaluación inicial y el tratamiento de pacientes con traumatismo craneoencefálico importante o de otro tipo **no** se analizan aquí. **El examen** y la evaluación clínica de adolescentes mayores y adultos con un SRC, y todos los demás aspectos del traumatismo craneoencefálico y la lesión cerebral, se revisan por separado:

- Evaluación clínica de SRC (consulte "Evaluación clínica de conmoción cerebral relacionada con el deporte en adolescentes y adultos")
- Evaluación del trauma (ver "Manejo inicial del trauma en adultos" y "Manejo del trauma: abordaje del niño inestable")

- Lesión cerebral traumática en adultos (ver "Lesión cerebral traumática leve aguda (conmoción cerebral) en adultos" y "Secuelas de lesión cerebral traumática leve" y "Manejo de lesión cerebral traumática aguda moderada y grave")

- Niños con conmoción cerebral (ver "Conmoción cerebral en niños y adolescentes: manifestaciones clínicas y diagnóstico" y "Conmoción cerebral en niños y adolescentes: tratamiento")

- Lesiones relacionadas con el deporte (consulte "Evaluación lateral de una conmoción cerebral" y "Evaluación del atleta adulto colapsado")

TRATAMIENTO

A continuación se proporciona nuestro enfoque para el tratamiento de pacientes que han sufrido una conmoción cerebral relacionada con el deporte (SRC). Suponiendo que no haya factores que compliquen, este enfoque es el mismo para el paciente con su primer SRC y para aquellos que han sufrido una o dos lesiones previas. Sin embargo, es posible que se necesite una evaluación más completa y un tratamiento más especializado si un atleta presenta alguno de los siguientes síntomas:

- Múltiples conmociones cerebrales
- Conmociones cerebrales causadas por un trauma progresivamente menos grave.
- Síntomas o déficits cognitivos cada vez más graves.
- Tiempos de recuperación más largos

En tales casos, el médico puede considerar que vale la pena iniciar una conversación sobre la participación continua en el deporte o actividad infractora. (Consulte 'Retiro del deporte' a continuación).

Intervenciones iniciales básicas y enfoque general : el tratamiento temprano común a casi todos los casos de SRC incluye lo siguiente:

- Descanso cognitivo y físico relativo según lo indicado durante 24 a 48 horas (ver 'Volver a aprender y trabajar' a continuación)
- Minimizar los estímulos visuales y auditivos (p. ej., detener o limitar la lectura y visualización de pantallas, evitar las multitudes)
- Buena higiene del sueño (consulte 'Alteraciones del sueño' a continuación)
- Hidratación y nutrición adecuadas.
- Analgésicos para el dolor de cabeza (ver 'Dolor de cabeza' a continuación)

Después de las primeras 24 a 48 horas después de la lesión, se puede reintroducir gradualmente una actividad física y cognitiva ligera, siempre que no empeoren los síntomas.

(Ver 'Ejercicio' a continuación.)

Anteriormente, las intervenciones terapéuticas más allá del simple descanso estaban reservadas para pacientes cuyos síntomas de conmoción persistían más de 10 a 14 días. Cada vez más, las intervenciones como el ejercicio aeróbico gradual, la fisioterapia y la rehabilitación vestibular se han iniciado tempranamente con buenos resultados [1,2]. Estas intervenciones se basan en una evaluación específica y la determinación de los dominios clínicos afectados [3]. (Ver "Evaluación clínica de conmociones cerebrales relacionadas con los deportes en adolescentes y adultos" .)

Ejercicio : a diferencia de protocolos anteriores que abogaban por un reposo físico y cognitivo estricto hasta que el paciente estuviera asintomático, el ejercicio se ha convertido en una parte importante del tratamiento del SRC. Las pautas de consenso establecen que el atleta no necesita estar libre de síntomas para comenzar a hacer ejercicio, pero recomiendan que el ejercicio no empeore los síntomas ni durante la actividad ni después [4,5]. En un ensayo aleatorio de 99 pacientes (de 11 a 22 años), no se encontraron diferencias clínicamente significativas en la reducción de los síntomas, el equilibrio o el rendimiento neurocognitivo entre aquellos asignados a un reposo estricto durante cinco días y aquellos a los que se les permitió un regreso temprano y gradual a la actividad después de uno a dos días de descanso [6].

Antes de introducir el ejercicio, el médico debería haber realizado un examen cuidadoso que excluya cualquier contraindicación, como enfermedades cardíacas o respiratorias, problemas vestibulares importantes y lesiones de las extremidades inferiores o de la columna cervical. (Consulte "Evaluación clínica de conmociones cerebrales relacionadas con el deporte en adolescentes y adultos", sección sobre "Evaluación clínica" .)

Nosotros y otros sugerimos un breve período de relativo descanso físico y cognitivo durante 24 a 48 horas inmediatamente después de la lesión, seguido de una introducción y un aumento gradual del ejercicio. Los tipos de ejercicio iniciales deben ser actividades aeróbicas suaves que **no empeoren los síntomas** y **no supongan ningún riesgo de caída** o de sufrir más lesiones en la cabeza. Los ejemplos incluyen andar en bicicleta estática y caminar. La prueba de ejercicio estandarizada es un método útil para introducir un estrés físico controlado y evaluar la respuesta del paciente. Los protocolos validados que se pueden utilizar para evaluar a los pacientes e introducir el ejercicio incluyen la prueba de cinta rodante Balke [7], la prueba en cinta rodante de conmoción cerebral de Buffalo y la prueba de bicicleta de conmoción cerebral de Buffalo [8] .]. La frecuencia cardíaca, el esfuerzo percibido y cualquier síntoma deben registrarse mientras el paciente está en reposo, durante todos los grados de ejercicio y durante la recuperación.

Gradualmente, a lo largo de días o semanas, dependiendo de la gravedad de los síntomas, se puede introducir una actividad más exigente según la evaluación clínica y el progreso (es

decir, la mejora de los síntomas). Ejercicios como el entrenamiento de resistencia, el ejercicio anaeróbico intenso (p. ej., carreras de velocidad, trabajo de agilidad) y el entrenamiento de contacto controlado deben realizarse sólo con una estrecha supervisión y basándose en el progreso clínico adecuado. Los síntomas deben controlarse durante y después de cada exposición [9]. Se proporciona un enfoque general para volver al deporte (tabla 1).

El ejercicio, cuando se introduce y se realiza correctamente, mejora la función del sistema nervioso autónomo, el estado de ánimo, el sueño y posiblemente otros síntomas relacionados con el SRC. Por el contrario, el ejercicio intenso y descontrolado realizado prematuramente puede exacerbar los efectos del SRC en el sistema nervioso autónomo y empeorar los síntomas.

La intolerancia al ejercicio demostrada por algunos atletas después de un SRC puede estar relacionada con una regulación anormal del flujo sanguíneo cerebral. A medida que aumenta la tolerancia al ejercicio aeróbico, mejora la función del sistema nervioso autónomo. Por lo tanto, el ejercicio por debajo del umbral de los síntomas puede ser terapéutico para el SRC, pero se necesita más investigación.

Se ha empleado de forma segura una evaluación sistemática de la tolerancia al ejercicio mediante la prueba de conmoción cerebral de Buffalo para prescribir un programa de ejercicio aeróbico progresivo e individualizado con actividad por debajo del umbral de síntomas que permite a los pacientes volver al deporte y al trabajo [8,10,11] . Se deben realizar estudios adicionales para determinar la eficacia y el momento óptimo, la dosis y la duración del ejercicio aeróbico subumbral de forma aguda después del SRC.

Terapia farmacológica para el SRC : no existen medicamentos ni suplementos que hayan demostrado acelerar la recuperación después de una conmoción cerebral. Los médicos deben dejar esto claro a los atletas, padres/tutores, entrenadores y otras partes interesadas. Dependiendo de los síntomas y las comorbilidades del paciente, se pueden usar medicamentos para tratar afecciones específicas, como migraña o ansiedad.

Headache — Headache is the most common symptom associated with concussion [12-14]. Treatment is guided by the type of headache. The three most common types of postconcussive headache are migraine-like (approximately 50 percent), tension-type (approximately 32 to 37 percent), and cervicogenic (approximately 4 percent) headache [14]. Postconcussive headache is discussed in greater detail separately. (See "Concussion in children and adolescents: Management", section on 'Symptom management' and "Post-traumatic headache".)

In the immediate 24 to 48 hours after injury, acetaminophen is typically recommended for relief of headache, as it does not increase the risk for intracranial bleeding. When the presence of an intracranial bleed is deemed unlikely, most often because of improving

symptoms when the patient is reassessed at 24 to 48 hours, patients may use other basic analgesics, such as ibuprofen, for acute post-traumatic headache. Patients with a prior history of migraine headache who develop symptoms typical of previous attacks can be treated with their usual abortive medications. If these interventions are ineffective, additional steps are taken, as outlined in the following discussion. We advise against using medications such as opioids that may affect the patient's sensorium or cognition, as such treatment may impede recovery and complicate assessments of clinical progress. (See "Post-traumatic headache", section on 'Treatment'.)

Headaches associated with an SRC may arise from or be exacerbated by other factors, including visual disturbances, photophobia, cervical injury, anxiety, stress, dehydration, nutritional deficits, and menstruation. In such cases, nonpharmacologic interventions such as physiotherapy, acupuncture, and massage may provide some relief in addition to standard treatments.

Free magnesium levels are often low in patients with migraine headaches, and magnesium may safely be used in post-traumatic headaches, although there remains insufficient evidence of efficacy [15,16]. Magnesium glycinate and magnesium citrate (400 to 600 mg daily) are more easily absorbed and have fewer gastrointestinal side effects.

Sleep disturbances — Good sleep hygiene is important for all patients recovering from a concussion and is an essential intervention for those whose recovery is complicated by insomnia or other forms of disturbed sleep (table 2 and table 3). Sleep hygiene includes [17]:

- Eliminating screen time in the evening before bedtime
- Avoiding caffeine and alcohol, particularly in the hours before bedtime
- Sleeping in a dark, cool, quiet room
- Minimizing/eliminating daytime napping
- Performing daily exercise (ideally not late in the evening)

Patients should try to maintain a regular sleep schedule consistent with normal circadian rhythms. Most importantly, patients should allow themselves sufficient time to sleep each day, as an increased need for sleep (pleiosomnia) is frequently observed after concussion and other traumatic brain injury. Individual time needs for sleep can be estimated based on whether the patient feels well rested after sleep and throughout the day or based on sleep times when no limits are set, such as during weekends and holidays. Ideally, sleep should not be curtailed by alarm clocks or other means.

If possible, daytime naps are best avoided, unless this was part of an athlete's routine prior to their concussion and should be brief if taken. Naps should be avoided if night-time sleep has become interrupted. Daytime sun exposure combined with light exercise may help

address circadian dysregulation. The management of insomnia and of other forms of disturbed sleep is reviewed separately. (See "Overview of the treatment of insomnia in adults" and "Behavioral sleep problems in children".)

In some cases, treatment with melatonin may be helpful. The best-established use is for patients with delayed circadian rhythms, who have difficulty falling asleep until late in the evening and then oversleep in the morning. For such patients, melatonin is typically given nightly, one to two hours before the desired bedtime. Timed dosing, in combination with behavioral modifications, aims to restore healthy circadian rhythms. Administration of melatonin and supporting evidence in this setting are reviewed separately. (See "Delayed sleep-wake phase disorder", section on 'Management'.)

Melatonin has also been studied as a treatment for disturbed sleep more generally in patients with traumatic brain injury, with mixed results [18]. Its effects are generally modest, and the main appeal is its relative safety and tolerability compared with other medications for insomnia. (See "Sleep-wake disorders in patients with traumatic brain injury", section on 'Insomnia'.)

The use of sedatives, including benzodiazepines and atypical gamma aminobutyric acid agonists, to treat disturbed sleep following SRC is discouraged because of the potential negative effects on cognition [19]. However, athletes previously prescribed sedatives or other medications for anxiety or depression diagnosed prior to any concussion should continue these therapies as indicated.

A variety of other sleep disorders may occur in the subacute to chronic phase of concussion recovery (figure 1). Excessive daytime sleepiness is common and may require a multifaceted approach. Evaluation and management are reviewed in more detail separately. (See "Sleep-wake disorders in patients with traumatic brain injury".)

Ocular or vestibular dysfunction — Limited evidence and the authors' clinical experience suggest that early initiation of a vestibular or ocular rehabilitation program (or both) may be helpful for patients with persistent symptoms [20,21]. This may involve referral to a physical therapist or other appropriately skilled clinician with an understanding of ocular and vestibular dysfunction. Specific management may include exercises for eye movement, accommodation, head movement, and balance. Where such specialist care is not available, a basic home exercise program may be used. (See "Sequelae of mild traumatic brain injury", section on 'Posttraumatic vertigo and dizziness'.)

Mood disorders and anxiety — While not as common as headache or cognitive findings, anxiety and mood-related symptoms are relatively common with SRC. The first step in addressing such problems involves educating the athlete about the injury, specifics of treatment, and the expectation that the vast majority of athletes experience timely

improvement in symptoms and dysfunction and ultimately complete resolution. Such education is often effective.

Cognitive therapy and psychotherapy can play an important role in managing mood disorders that develop following an SRC. These should be implemented before medication is introduced. However, athletes previously prescribed sedatives or other medications for anxiety or depression diagnosed prior to any concussion should continue these therapies as indicated. Such patients should be evaluated by the clinician who treats their psychiatric illness in addition to the clinician managing their SRC. Specialist psychiatric consultation should be obtained if there is inadequate or no response to cognitive therapy.

Anxiety and mood-related symptoms are associated with delayed recovery and return to sport. (See 'Return to sport' below.)

Attention deficit — New-onset concentration deficits, which are common in the acute and subacute stages of SRC, should not be treated with stimulant medication initially. However, in patients already taking a stimulant medication for a previously diagnosed attention disorder, the medication should only be withheld during the initial 24 to 48 hours following injury. It should then be resumed. All other cognitive and exercise restrictions should be observed in such patients.

Adjunctive treatments — A number of supplements have been proposed as adjunct treatments for concussion, but research is scant and not specific to concussion [22]. As an example, a form of omega-3 fatty acid, docosahexaenoic acid (DHA), the predominant omega-r fatty acid found in the phospholipid membranes of neurons, at a dose of 2000 mg per day has been proposed to speed recovery in children [23].

RETURN TO SPORT

The goal of return-to-sport protocols is to enable athletes to return safely to sport when they are neurologically and physically able. Return-to-sport planning begins at the time of initial evaluation and requires coordination among clinicians, athletic trainers, coaches, parents/guardians, and the athlete. Only limited evidence is available, and return-to-sport plans are guided primarily by expert opinion. Protocols typically involve a stepwise progression beginning with activities of daily living and advancing through subsequent stages that introduce activities posing greater cognitive and physical demands, culminating in sport-specific activities. The time required for resolution of symptoms and return to full sport is discussed below. (See 'Prognosis' below.)

The evaluating clinician relies on the athlete and athletic trainer to inform them of the athlete's progress. The clinician needs assurance that the athlete has no unresolved

concussion symptoms or functional deficits, and that each stage has been completed without provoking symptoms, before allowing the athlete to return to full competition. The widely used Concussion in Sport Group return-to-sport protocol provides a sound approach and is provided here (table 1). The approach does not differ based on the type of sport to which the athlete is returning, be it collision (eg, rugby, American football, ice hockey), combat (eg, judo, wrestling), contact (eg, basketball, football [soccer]), or non-contact (eg, tennis, volleyball).

Before an athlete begins a return-to-sport protocol, all concussion-related symptoms should be resolved (or, at a minimum, stable and not severe). The content of each stage or phase may be individualized based on the sport, age, level of play, and degree of supervision [24]. As a general rule, each stage should last a minimum of 24 hours, and performance of all tasks at a given stage must not provoke symptoms before the athlete is permitted to move to the next stage. If symptoms do develop, the athlete should return to the previous stage. The time course for advancement may be modified based on individual factors such as a history of prior SRCs, previous recovery patterns, or specifics of the current injury.

The athlete must achieve the following to meet the minimum requirements for a full return to sport:

- Complete resolution of symptoms; return to preinjury state
- Neurocognitive function at preinjury baseline measures if available or at expected level based on population norms
- No symptoms provoked by full physical exertion
- No symptoms provoked by cognitive exertion or visual stress
- Return-to-sport protocol or equivalent is completed
- Athlete must express a desire to return to sport
- Athlete must show they understand the possible long-term risks of re-injury (clinicians should provide clear explanations in language the athlete understands [25])

More severe symptoms initially and prominent anxiety or mood-related symptoms are associated with delayed recovery and return to sport. In a study of over 2000 high-level collegiate athletes in the United States, the reporting of affective symptoms (ie, more emotional, irritability, sadness, and/or nervousness or anxiety) was associated with significant delays in full return to play [26].

The athlete and others (eg, parents/guardians of adolescents) should be made aware of the possible long-term risks associated with their return to contact or collision sports. It should be made clear that our understanding of the long-term risks from repetitive head trauma is incomplete and evolving [25]

Return to sport typically occurs in parallel with a return to academics ("return to learn"), work, or service [24]. In school-age athletes, return to sport should not occur ahead of a return to learning. Information on returning to school and work is provided below.

Consideration should also be given to when it is safe to return to driving, as post-concussion deficits in driving ability have been demonstrated [27]. A discussion of potential risks is warranted [24].

RETURN TO LEARN AND WORK

Patients recovering from an SRC should return to school and work after a brief period of rest as their symptoms permit. The return to school for children and younger adolescents is discussed separately. (See "Concussion in children and adolescents: Management", section on 'Return to learn'.)

The rate at which patients can resume learning, reading, and using a computer will vary based on symptoms. In a systematic review of 278 studies notable for a large degree of heterogeneity, the average time for a concussed athlete to resume learning without restrictions was 8.3 days (95% CI 5.6-11.1), with 93 percent of athletes achieving this milestone by 10 days [28]. In a multisite, prospective study of over 1700 college athletes in the United States with an SRC, the median time until return to full academics was six days [29]. Students who resumed full coursework prior to the resolution of symptoms were significantly more likely to experience a prolonged recovery (21.5 percent less likely to return to full sport within 14 days; 95% CI -27.4 to -15.5) and delayed return to full sport (19.1 percent more likely to return after 28 days; 95% CI 13.4-24.7).

Athletes who experience photophobia, headaches, and cognitive manifestations progress more slowly. Individualized accommodations at school, university, and work may be needed (table 4). Communication among the clinician, patient, family, teachers, school health personnel, and supervisors is important. Examples of accommodations that may be needed are provided (table 5).

PROGNOSIS

The prognosis and possible sequelae of traumatic brain injury, including chronic traumatic encephalopathy, are discussed in detail separately; early recovery from such injury as it relates to a return to participation in sport is reviewed below. (See "Sequelae of mild traumatic brain injury" and "Postconcussion syndrome" and "Concussion in children and adolescents: Management".)

Overall recovery — The overwhelming majority of athletes who sustain an SRC can expect to return to their preinjury baseline in terms of symptoms and function. An SRC is considered resolved when the following criteria are met:

- All concussion-related symptoms have resolved, both at rest and during full cognitive stress or full physical exertion
- All neurologic, neurocognitive, vestibular, ocular, and oculomotor functions have returned to baseline

Clinical symptoms of SRC resolve in 80 to 90 percent of older adolescents and adults within two weeks [30]. In younger athletes and adults over 40 years of age, this can take longer, with most returning to preinjury levels of function within four weeks [31]. In a systematic review of 278 studies notable for a large degree of heterogeneity, the average time for a concussed athlete to resume full sport was 19.8 days (95% CI 18.8-20.7) [28].

Relatively few athletes (2.9 percent) are medically disqualified for the remainder of their season or permanently [32,33]. However, it should be emphasized that the duration of recovery is variable and dependent upon a variety of factors, including intrinsic and injury-specific risk factors, treatment, athlete compliance, and motivation. Predicting the duration of symptoms is an inexact science. (See "Clinic-based evaluation of sports-related concussion in adolescents and adults", section on 'Risk factors for more severe concussion'.)

Predicting duration of symptoms — Our understanding of symptom resolution following SRC continues to evolve [34-37]. While definitive studies are lacking, we believe that normal recovery from an SRC is a process requiring up to one month [38].

Earlier studies reported that nearly all collegiate American football players experienced a resolution of symptoms by day seven [39], but subsequent research describes significant numbers of athletes with symptoms and clinical deficits lasting beyond seven days [24,30,38,40,41]. In a large observational study of collegiate athletes from multiple sports, the median time for return to play was 12.8 days, with 9 percent of athletes not fully recovered at 28 days [42]. Some have expressed concern that the resolution of symptoms and measurable neurocognitive deficits as determined by typical office-based assessments may not reflect true physiologic recovery [43].

Prognostication based on pre-existing conditions, history, symptoms, and physical examination findings is challenging, but some factors appear to be associated with longer recovery times. While this research is limited, some highlights include the following:

- **History of neuropsychiatric disorder** – A pre-existing mental health condition, particularly depression, is associated with an increased risk for prolonged symptoms [44]. Conversely, athletes with attention-deficit hyperactivity disorder (ADHD) or

learning disabilities do not appear to be at risk for prolonged recovery [44]. In a large observational study, patients with ADHD recovered faster than unaffected patients even after controlling for stimulant therapy [42].

- **History of brain injury** – Recovery has been reported to be prolonged in athletes with ≥3 previous concussions [42].

- **Sex and age** – The role of sex remains unclear. While some studies report that recovery is prolonged in female athletes [33,42,44], an analysis of over 1000 concussions in United States collegiate athletes reported no differences in recovery time between females and males [45].

  Adolescents appear to have longer recovery than young adults [44]. Adolescent athletes whose symptoms are provoked at lower heart rates during a graded exercise test within a week of sustaining an SRC have a longer recovery time [46].

- **Symptom type and severity** – Greater number and severity of acute and subacute symptoms suggest a longer recovery [28,33,42,44], with headache and depression in the subacute period after injury associated with symptoms persisting beyond one month [44]. Early work on the relationship of physical examination findings to recovery suggests that vestibular impairment is associated with delayed recovery [45]. In some cases, balance deficits identified during the performance of dual tasks persist even after a return to normal daily activities [47,48].

- **Delayed diagnosis** – Delayed recognition of an SRC leading to continued play or exertion (eg, practice), regardless of whether additional head trauma was sustained, is associated with a greater symptom burden and prolonged recovery by three to five days [28,49,50].

- **Biomarkers and imaging** – No clinically available blood or salivary biomarkers or imaging methods have been found to predict recovery times accurately [51]. Preliminary laboratory studies suggests that total tau and glial fibrillary acidic protein concentrations may correlate with time required to return to sport, but further study is needed [52].

- **Heat, altitude, and other environmental factors** – Although once thought to affect SRC presentation and recovery, altitude up to 2500 m and on-field heat index at the time of injury do not appear to exacerbate symptoms [53]. Commercial airplane travel early after a concussion does not affect symptom severity or recovery following an SRC [54].

Other sequelae — Of note, SRC is associated with an increased rate for lower extremity injury in the months immediately following return to sport [55].

The sequelae of brain injury, including chronic traumatic encephalopathy, are discussed in detail separately. (See "Sequelae of mild traumatic brain injury" and "Postconcussion syndrome" and "Concussion in children and adolescents: Management".)

RETIREMENT FROM SPORT

General considerations — The decision to retire from sport because of the effects of an SRC can be difficult, and there is little high-quality evidence available to guide such decisions [56,57]. If symptoms recur frequently or are particularly severe, the decision may be clear. However, the issues around reinjury and long-term risk can be challenging.

We believe that the decision to retire from a contact or collision sport should be made by the athlete in close consultation with the primary clinician and other trusted members of the athlete's social network, possibly including parents/guardians, spouse or partner, siblings, friends, coaches, teammates, work colleagues, and members of their academic support team. The decision may be informed by input from medical specialists with expertise in those clinical domains most affected. (See "Clinic-based evaluation of sports-related concussion in adolescents and adults", section on 'Concussion symptom categories (clinical domains)'.)

The decision need not be made immediately. It is appropriate to consider the decision over weeks to months, during which time symptoms are monitored and feedback is provided. Below, we provide some guidance for approaching the question of retirement from sport following SRC.

The question "how many is too many?" has no definitive answer. However, there is evidence of increased neurodegeneration and mortality among some participants in contact and collision sports that must be considered. When concussions are recurrent, occur from less impact, or cause prolonged symptoms, clinicians should warn athletes of potential long-term sequelae. In these situations, it is reasonable to remove the athlete from contact sport for a prolonged period (three to six months). This rest period can be used to address any identified deficits or problems and then re-evaluate. (See "Sequelae of mild traumatic brain injury".)

Joint decision-making — In some cases, an athlete may decide to retire from a sport based upon their own interpretation of their symptoms and assessment of their future risk. However, when making this decision, athletes often rely upon input from many people, possibly including their family, spouse or partner, friends, coaches, teammates, work colleagues, academic support team, and medical team. The team doctor, family or personal physician, and neurologist may all act as a sounding board for the athlete. In addition, the athlete may seek input from specialists, possibly including neurosurgeons,

otolaryngologists, physical or occupational therapists, psychiatrists, clinical or neuropsychologists, and ophthalmologists.

Clinical evaluation — As with early assessments following acute injury, the medical evaluation of a player who has suffered numerous concussions, is experiencing prolonged symptoms, or is seeking advice regarding a future in contact sport should be thorough and cover all relevant clinical domains. Those domains that appear to be particularly problematic should prompt referral to a specialist.

Serial assessments — Many specialist evaluations must be repeated to determine whether the athlete's condition is improving. The primary supervising clinician should receive feedback after any specialist consultation and discuss the latest findings with the athlete. Decisions not to participate in sport may be provisional (for weeks or months) pending the results of future reassessments. Conversations about participation and risk may take place at any time, especially when new information comes to light or it becomes clear that the athlete's condition is becoming chronic.

Exercise stress tests — In cases where symptoms have resolved at rest, an exercise program with a gradual increase in intensity can be used to determine whether symptoms are provoked by physical stress.

SOCIETY GUIDELINE LINKS

Links to society and government-sponsored guidelines from selected countries and regions around the world are provided separately. (See "Society guideline links: Sports-related concussion" and "Society guideline links: Minor head trauma and concussion".)

SUMMARY AND RECOMMENDATIONS

- **Basic initial interventions** – Early treatment common to nearly all cases of sports-related concussion (SRC) includes the following (see 'Basic initial interventions and general approach' above):
  - Relative cognitive and physical rest as indicated for 24 to 48 hours
  - Minimizing visual and auditory stimuli (eg, stopping or limiting screen viewing and reading, avoiding crowds)
  - Good sleep hygiene
  - Proper hydration and nutrition
  - Analgesics for headache

- **Exercise** – Following the initial 24 to 48 hours of relative rest, athletes need not be symptom free to begin light exercise. Exercise should begin with easy aerobic activities that **do not worsen symptoms** and **do not entail any risk of falling** or sustaining further head injury. Gradually, over days to weeks depending on the severity of symptoms, more demanding activity is introduced while monitoring closely for symptoms, particularly those in the domains predominately affected. (See 'Exercise' above.)

- **Pharmacologic therapy** – There are no medications or supplements that have been shown to speed recovery following concussion. Clinicians should make this clear to athletes, parents/guardians, coaches, and other concerned parties. (See 'Pharmacologic therapy for SRC' above.)

- **Headache** – In the immediate 24 to 48 hours after injury, acetaminophen is typically given for relief of headache. Once the presence of an intracranial bleed is deemed unlikely, most often because of improving symptoms, patients may use other basic analgesics, such as ibuprofen. Patients with a prior history of migraine headache who develop symptoms typical of previous attacks can be treated with their usual abortive medications. If these interventions are ineffective, additional steps may be needed. (See "Post-traumatic headache", section on 'Treatment'.)

- **Sleep** – All patients recovering from an SRC should allow themselves sufficient time to sleep and adhere to sound sleep hygiene (table 2 and table 3), including (see 'Sleep disturbances' above):

  - Eliminating screen time in the evening before bedtime
  - Avoiding caffeine and alcohol, particularly in the hours before bedtime
  - Sleeping in a dark, cool, quiet room
  - Minimizing/eliminating daytime napping
  - Performing daily exercise (ideally not late in the evening)

- **Ocular or vestibular dysfunction** – For patients with persistent symptoms of vestibular or ocular dysfunction, focused rehabilitation programs may be helpful. These generally entail referral. (See 'Ocular or vestibular dysfunction' above.)

- **Mood disorders and anxiety** – Educating the athlete about SRC and the expectation that the vast majority of players experience timely improvement in symptoms and dysfunction, and ultimately complete resolution, is often helpful. Cognitive therapy and psychotherapy can play an important role in managing mood disorders. Athletes previously prescribed sedatives or other medications for anxiety or depression diagnosed prior to any concussion should continue these therapies as indicated under

the supervision of the prescribing clinician. Anxiety and mood disorders are associated with delayed return to sport. (See 'Mood disorders and anxiety' above.)

- **Attention deficits** – New-onset concentration deficits, which are common in the acute and subacute stages of SRC, should **not** be treated with stimulant medication initially. In patients already taking a stimulant medication for a previously diagnosed attention disorder, the medication should only be withheld during the initial 24 to 48 hours following injury. (See 'Attention deficit' above.)

- **Return to sport** – We suggest that athletes meet minimum requirements before returning to full sport, including the following (**Grade 2C**) (see 'Return to sport' above):

  - Complete resolution of symptoms; return to preinjury state
  - Neurocognitive function at preinjury baseline measures if available or at expected level based on population norms
  - No symptoms provoked by full physical exertion
  - No symptoms provoked by cognitive exertion or visual stress
  - Return-to-sport protocol or equivalent is completed

  The return to school for children and adolescents is discussed separately. (See "Concussion in children and adolescents: Management", section on 'Return to learn'.)

- **Prognosis** – Clinical symptoms of SRC resolve in 80 to 90 percent of older adolescents and adults within two weeks. In younger athletes and adults over 40 years of age, this can take longer, but most return to preinjury levels of function within four weeks. Few athletes (2.9 percent) are medically disqualified for the remainder of their season or permanently. Guidance about possible retirement from sport is provided. (See 'Prognosis' above and 'Retirement from sport' above.)

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Topic 138371 Version 12.0

GRAPHICS

Estrategia de regreso al deporte (RTS): cada paso suele tardar un mínimo de 24 horas

Paso	estrategia de ejercicio	Actividad en cada paso.	Meta
1	Actividad limitada por síntomas	Actividades diarias que no exacerban los síntomas (p. ej., caminar).	Reintroducción gradual del trabajo/escuela.
2	Ejercicio aerobico ▪ **2A - Luz** (hasta aproximadamente 55% maxHR) **luego** ▪ **2B - Moderado** (hasta aproximadamente 70 % de la FC máx.)	Stationary cycling or walking at slow to medium pace. May start light resistance training that does not result in more than mild and brief exacerbation* of concussion symptoms.	Increase heart rate.
3	Individual sport-specific exercise NOTE: If sport-specific training involves any risk of inadvertent head impact, medical clearance should occur prior to Step 3	Sport-specific training away from the team environment (eg, running, change of direction and/or individual training drills away from the team environment). No activities at risk of head impact.	Add movement, change of direction.
Steps 4 to 6 should begin after the resolution of any symptoms, abnormalities in cognitive function and any other clinical findings related to the current concussion, including with and after physical exertion.			
4	Non-contact training drills	Exercise to high intensity including more challenging training drills (eg, passing drills, multiplayer training) can integrate into a team environment.	Resume usual intensity of exercise, coordination and increased thinking.
5	Full contact practice	Participate in normal training activities.	Restore confidence and assess functional skills by coaching staff.
6	Return to sport	Normal game play.	

HCP: healthcare professional; maxHR: predicted maximal heart rate according to age (ie, 220-age).

* Mild and brief exacerbation of symptoms (ie, an increase of no more than 2 points on a 0 to 10 point scale for less than an hour when compared with the baseline value reported prior to

physical activity). Athletes may begin Step 1 (ie, symptom-limited activity) within 24 hours of injury, with progression through each subsequent step typically taking a minimum of 24 hours. If more than mild exacerbation of symptoms (ie, more than 2 points on a 0 to 10 scale) occurs during Steps 1 to 3, the athlete should stop and attempt to exercise the next day. Athletes experiencing concussion-related symptoms during Steps 4 to 6 should return to Step 3 to establish full resolution of symptoms with exertion before engaging in at-risk activities. Written determination of readiness to RTS should be provided by an HCP before unrestricted RTS as directed by local laws and/or sporting regulations.

Graphic 61318 Version 13.0

Sleep hygiene guidelines

Recommendation	Details
Regular bedtime and rise time	Having a consistent bedtime and rise time leads to more regular sleep schedules and avoids periods of sleep deprivation or periods of extended wakefulness during the night.
Avoid napping	Avoid napping, especially naps lasting longer than 1 hour and naps late in the day.
Limit caffeine	Avoid caffeine after lunch. The time between lunch and bedtime represents approximately 2 half-lives for caffeine, and this time window allows for most caffeine to be metabolized before bedtime.
Limit alcohol	Recommendations are typically focused on avoiding alcohol near bedtime. Alcohol is initially sedating, but activating as it is metabolized. Alcohol also negatively impacts sleep architecture.
Avoid nicotine	Nicotine is a stimulant and should be avoided near bedtime and at night.
Exercise	Daytime physical activity is encouraged, in particular, 4 to 6 hours before bedtime, as this may facilitate sleep onset. Rigorous exercise within 2 hours of bedtime is discouraged.
Keep the sleep environment quiet and dark	Noise and light exposure during the night can disrupt sleep. White noise or ear plugs are often recommended to reduce noise. Using blackout shades or an eye mask is commonly recommended to reduce light. This may also include avoiding exposure to television or technology near bedtime, as this can have an impact on circadian rhythms by shifting sleep timing later.
Bedroom clock	Avoid checking the time at night. This includes alarm clocks and other time pieces (eg, watches and smart phones). Checking the time increases cognitive arousal and prolongs wakefulness.
Evening eating	Avoid a large meal close to bedtime. Eat a healthy and filling (but not too heavy) meal in the early evening and avoid late-night snacks.

Graphic 122804 Version 4.0

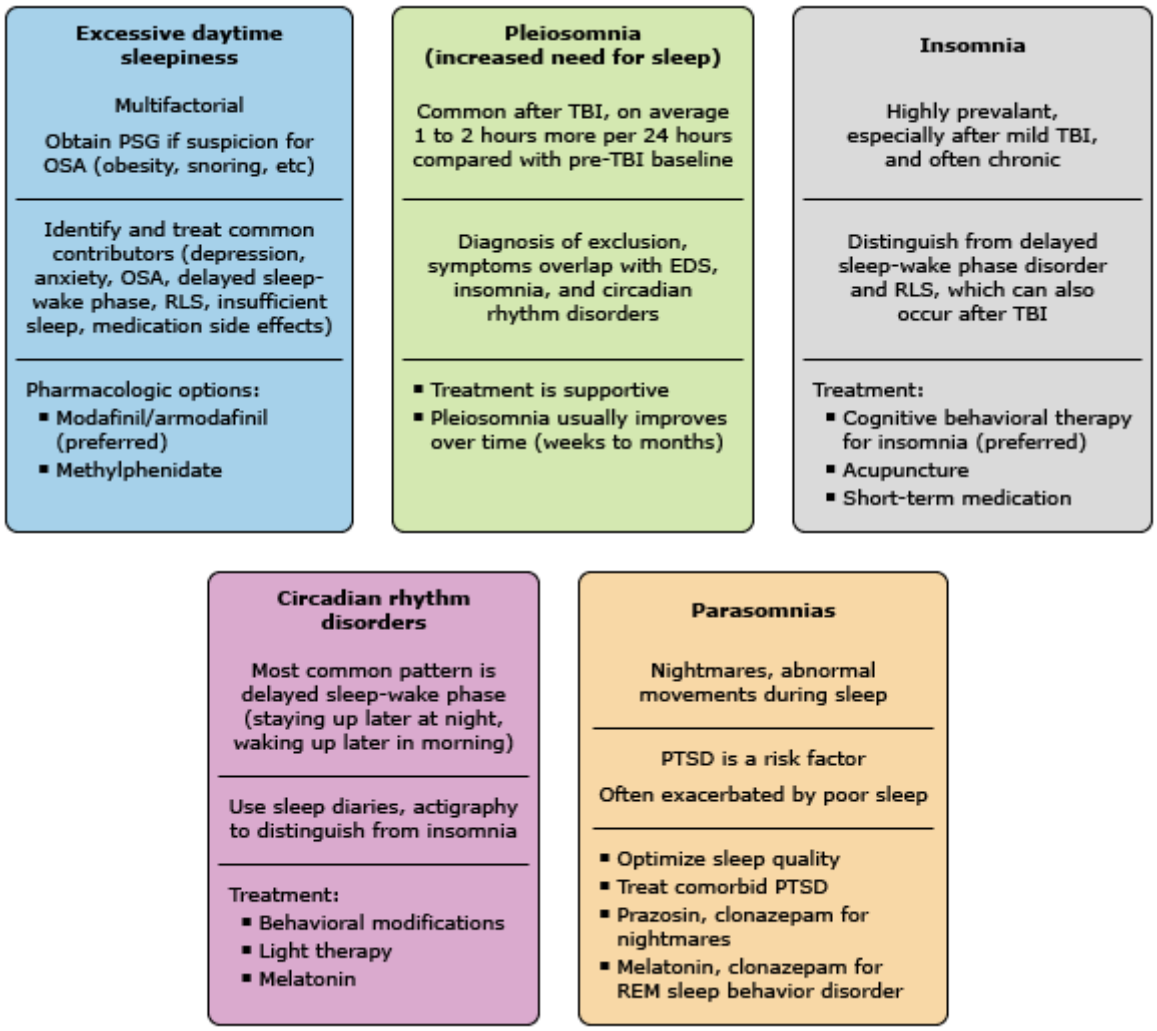
Healthy sleep practices for adolescents

Guidance to parents	Comments
Try to get your teenager to go to bed around the same time each night and wake up around the same time each morning.	Your teen should not need to sleep much later than an hour or so on weekends. This can make it hard to switch back to the school-day schedule. If your teen consistently wants to sleep for more than 2 hours extra on weekends, it suggests that they may not be getting sufficient sleep during the week.
Encourage your teen to avoid caffeine (coffee, energy drinks, etc) altogether but particularly in the afternoon and evening.	Caffeine is not a substitute for sufficient sleep. Caffeine can cause insomnia, increase anxiety, and may cause headaches during withdrawal from daily use.
Encourage daily exercise, but avoid intense exercise during the 2 to 3 hours before bedtime.	Exercise promotes deeper sleep, but intense exercise before bedtime can make it harder to fall asleep.
Don't allow your teen to play computer games, text, or do homework in bed.	The bed should be a quiet place just for relaxation and sleep.
Have your teen avoid bright lights from televisions, computers, and cell phones for at least 1 hour before bed.	Light from electronic devices in the hours before bed can shift the body's clock later, making it hard to go to sleep and then harder to wake up in the morning.
Encourage natural light exposure first thing in the morning, soon after waking up.	Natural light helps your teen wake up and get the day started.
Set limits, like no texting, phone, television, or computer during sleep hours.	Teens are most likely to meet this goal if their parent(s) or guardian(s) set a firm limit, including leaving their phones and any other devices outside of the bedroom.

* While these recommendations apply to adolescents in general, they are particularly pertinent for teens who are at risk for or have insomnia.

Graphic 120097 Version 2.0

Overview of sleep-wake disorders in patients with traumatic brain injury



Sleep-wake disturbances are among the most prevalent and persistent sequelae of TBI. Patients suffering from TBI of any severity, in both the acute and chronic phases, commonly report EDS, increased sleep need, insomnia, and sleep fragmentation. Identification and treatment of sleep disorders in patients with TBI is important and can complement other efforts to promote maximum functional recovery. Refer to UpToDate topic review on sleep-wake disorders in patients with TBI for more information.

PSG: polysomnography; OSA: obstructive sleep apnea; RLS: restless legs syndrome; TBI: traumatic brain injury; EDS: excessive daytime sleepiness; PTSD: posttraumatic stress disorder; REM: rapid eye movement.

Graphic 131183 Version 1.0

Guidance for initial cognitive recovery during high school or university following SRC

At home:

- Limit stressful brain activities (eg, studying, academic reading, math problems) to those most essential.
- Avoid screen time, such as texting, nonacademic computer work, video games, and television.
- When able, read and study in a quiet area with appropriate lighting (ie, not so dim as to cause eye strain and not so bright as to provoke photosensitivity).
- Take regular breaks (every 20 minutes) when doing homework or assignments.
- Report new or worsening symptoms following a learning exposure to your doctor.

At school/university:

- If you have symptoms such as headache, sensitivity to light or noise, nausea, or dizziness, do not attend school for the first 48 to 72 hours.
- Wait until you can tolerate 30 to 45 minutes of reading or studying at home without worsening symptoms before returning to school.
- Discuss your injury with your teachers, counselor, academic advisor, lecturers, and school health personnel; ask your doctor to provide feedback to them (you may need a formal medical note to obtain academic accommodations).
- Consider attending fewer classes – prioritize those most important.
- Get help with class notes & assignments: Ask a fellow student to share notes, use preprinted notes or academic services (eg, scribes), use recorded books, get help from a tutor.
- Stagger and request more time for assignments and examinations.
- If reading worsens symptoms, request oral assignments and tests.
- Schedule academic "time outs" during the school day when you can rest.
- Avoid noisy and excessively bright areas.

SRC: sports-related concussion.

Graphic 138761 Version 1.0

Potential adjustments for concussion symptoms in the school setting

Sign/symptom	Potential adjustments in school setting
Headache	■ Permit frequent breaks ■ Identify aggravators and reduce exposure to them ■ Provide rests, planned or as needed, in nurses office or quiet area
Dizziness	■ Allow student to put head down if symptoms worsen ■ Give student early dismissal from class and extra time to get from class to class to avoid crowded hallways
Visual symptoms: light sensitivity, double vision, blurry vision	■ Reduce exposure to computers, smart boards, videos ■ Reduce brightness on the screens ■ Allow the student to wear a hat or sunglasses in school ■ Permit use of audiotapes of books ■ Turn off fluorescent lights as needed ■ Seat student closer to the center of classroom activities (blurry vision) ■ Cover one eye with patch/tape one lens if glasses are worn (double vision)
Noise sensitivity	■ Allow the student to have lunch in quiet area with a classmate ■ Limit or avoid band, choir, or shop classes ■ Avoid noisy gyms and organized sports practices/games ■ Permit the use of earplugs ■ Give student early dismissal from class and extra time to get from class to class to avoid crowded hallways during pass time
Difficulty concentrating or remembering	■ Avoid testing or completion of major projects during recovery when possible ■ Provide extra time to complete nonstandardized tests ■ Postpone standardized testing (may require formal academic accommodation) ■ Considere una prueba por día durante los períodos de exámenes, según la tolerancia ■ Considere el uso de notas preimpresas, un anotador, un escriba o un lector para realizar exámenes orales.
Trastornos del sueño	■ Permitir un comienzo tardío o una jornada escolar más corta para recuperar el sueño. ■ Permitir descansos

Gráfico 91450 Versión 14.0

Contributor Disclosures

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El grupo editorial revisa las divulgaciones de los contribuyentes para detectar conflictos de intereses. Cuando se encuentran, estos se abordan mediante un proceso de revisión de varios niveles y mediante requisitos de referencias que se deben proporcionar para respaldar el contenido. Se requiere que todos los autores tengan contenido con las referencias adecuadas y deben cumplir con los estándares de evidencia de UpToDate.

Política de conflicto de intereses

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