



# ASSESSMENT & MANAGEMENT OF CONCUSSION IN SOCCER



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## PREFACE

Despite a growing body of medical literature addressing sport-related concussion, the injury remains one of the most complicated for medical providers to identify, evaluate, and manage. As an aid to clinical experience and judgment, this living document was created to encapsulate translational findings from the most recent scientific literature, as well as recommendations for best clinical practice to date. As the science around concussion evolves and clinical best practices change, so will this document.

The guidelines presented herein are designed to provide a framework for medical providers working with soccer athletes with gold standard practices and recommendations as resources allow. While state laws, organizational position statements and consensus guidelines from multiple medical fields are generally consistent with one another, subtle variations do exist. As such, individual medical providers should be intimately familiar with the professional documents and standards relevant to their clinical practice and provide care meeting the highest standard. Thus, local organizing bodies and clinicians will, by necessity, implement this document in varying ways based on real world practicalities and available resources. Ultimately, the contents of this document do not replace the exercise of sound clinical judgment in practice, as the medical provider should always make decisions with the athlete's short and long-term health and wellness in mind.

To achieve this end, when resources allow, medical providers (i.e., those with training and credentialing specific to concussion) are recommended to be present at every soccer event (games, practices, conditioning, etc.) and are empowered with unchallengeable medical decision-making power in the diagnosis and management of concussion.





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## INTRODUCTION

Mild traumatic brain injury (mTBI), commonly referred to as concussion, has over 101 definitions<sup>1</sup>. Most relevant to those providing medical care to soccer athletes is the clinical definition provided by the 2017 Concussion in Sport Group (CISG)<sup>2</sup>, which states:

Sport-related concussion (SRC) is a traumatic brain injury induced by biomechanical forces. Several common features that may be utilized in clinically defining the nature of a concussive head injury include:

- SRC may be caused either by a direct blow to the head, face, neck or elsewhere on the body with an impulsive force transmitted to the head.
- SRC typically results in the rapid onset of short-lived impairment of neurological function that resolves spontaneously. However, in some cases, signs and symptoms evolve over a number of minutes to hours.
- SRC may result in neuropathological changes, but the acute clinical signs and symptoms largely reflect a functional disturbance rather than a structural injury and, as such, no abnormality is seen on standard structural neuroimaging studies.
- SRC results in a range of clinical signs and symptoms that may or may not involve loss of consciousness. Resolution of the clinical and cognitive features typically follows a sequential course. However, in some cases symptoms may be prolonged.

In addition, the clinical signs and symptoms cannot be explained by drug, alcohol, or medication use, other injuries (such as cervical injuries, peripheral vestibular dysfunction, etc.) or other comorbidities (e.g., psychological factors or coexisting medical conditions).

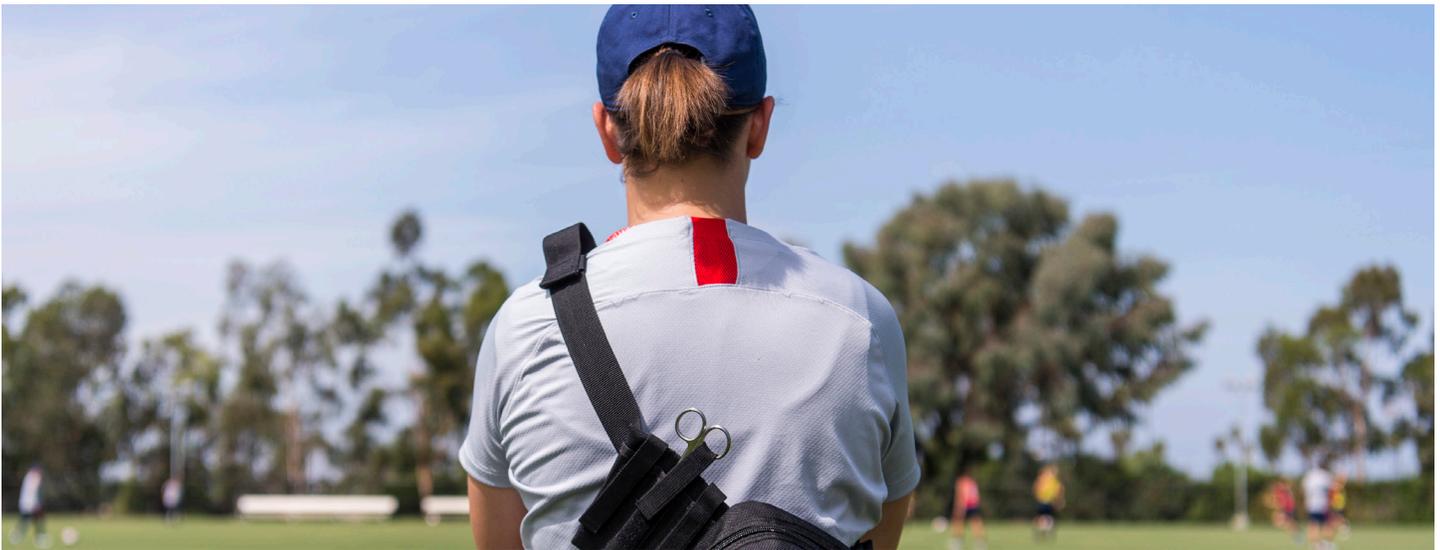
In the context of soccer, concussions occur at all levels of play (i.e., youth through professional) and are common among both male and female participants. For reasons not clearly understood, younger female athletes are at greater risk for injury and may have modestly extended recovery times<sup>3,4</sup>. Direct head-to-head contact, typically occurring when two athletes attempt to head the same ball, is the most common injury mechanism<sup>5</sup>, although contact with any object or person on or around the field can result in injury.





## INITIAL ASSESSMENT

The Initial Assessment (i.e., <72 hours following injury) may be conducted on the sideline, in the locker room, athletic training room, or clinic following the initial presentation of a possible concussion. The intent of the Initial Evaluation is to establish or exclude the diagnosis of concussion. To do so, the medical provider should obtain a thorough history of the injury event and conduct a comprehensive clinical examination, including a symptom evaluation, an assessment of cognitive function (e.g., SAC and/or computerized assessment), and an assessment of motor control (e.g., mBESS). Performance on these assessments is ideally compared to the pre-season, pre-injury evaluation, although normative data from the scientific literature and/or manufacturers may be used when individual pre-injury data are not available and, ultimately, post-injury assessments remain useful clinically even when a pre-injury comparison is not available. In most settings the Initial Examination is best facilitated by the SCAT5.



In all situations, the history and clinical examination, performed by a credentialed medical provider appropriately trained in sport concussion, serves as the gold standard for concussion diagnosis. Those without medical credentials, but who suspect an athlete is concussed, should remove the athlete from participation (i.e., game, practice, conditioning, etc.) and not allow their return until appropriately medically credentialed personnel can evaluate them. Under no circumstances should anyone (medically credentialed or not) evaluating a potentially concussed athlete use an assessment tool in isolation to confirm or exclude a concussion diagnosis.

## CLINIC ASSESSMENT

The Clinic Assessment is any injury evaluation following the Initial Evaluation and/or >72 hours post-injury. The intent of the Clinic Evaluation(s) can be to: 1) confirm or exclude a concussion diagnosis, 2) manage the concussed athlete during the recovery process, or 3) clear an athlete to return to full sport participation. There are no pre-determined number of post-injury evaluations that need to be conducted, but it is common to track athlete-reported symptoms initially on a daily basis, with a more comprehensive examination conducted at the time the athlete begins the return-to-play process (see below) and before unrestricted return to play. Those implementing the SAC and BESS components of the SCAT5 should be aware of the declining sensitivity beyond 72 hours post-injury that may limit the clinical utility of the findings. The decision for the implementation of symptom scales and/or computerized neurocognitive tools is left to the discretion of the medical provider.

At the time of writing, the assessments listed above are the most widely accepted by multiple sports organizations<sup>2,15-17</sup>. Other evaluation techniques have shown promise in aiding the clinical decision-making process but have not yet been widely adopted, nor do they replace the clinical examination and sound medical judgement. As such, clinicians may implement these emerging techniques into the medical practice at their discretion, with an understanding of the current limitations of the evidence for their use.



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## CONCUSSION IDENTIFICATION

Outside of injury reported by the athlete or another individual, apparent signs from a potentially concussed athlete are listed below<sup>9</sup>. Even without overt signs of concussion, any athlete with a suspected injury should be removed from participation and evaluated by a medical provider with training and experience caring for concussions. The apparent signs of concussion may include, but are not limited to:

**Lying motionless on the playing surface  
Motor incoordination including (but not limited to): balance and/or gait difficulties, stumbling, slow or labored movements**

**Disorientation or confusion, or an inability to respond appropriately to questions**

**Blank or vacant look**

**Facial injury after head contact**



## CONCUSSION IDENTIFICATION

Identifying athletes with concussion or suspected of having a concussion is one of the greatest challenges faced by medical providers. Once considered a hallmark of the injury, loss of consciousness occurs in only 5% or fewer of injuries<sup>3</sup>. Other clinical signs and symptoms associated with concussion may not develop for minutes to hours after injury<sup>6</sup>. In addition, clinical signs may be difficult to detect and symptoms may not be disclosed by an athlete who desires to continue to play or is unaware they are concussed<sup>7,8</sup>. As such, medical providers must be vigilant in their observation of athletes under their care, both on and off the field, and during and after events.

Nonetheless, concussive injuries often do not manifest overt signs, making it impossible for even the most diligent medical provider to identify all concussed athletes. Athletes, teammates, coaches, and officials, therefore, have an obligation to report concussions in a manner that is consistent with the “#TTPledge.” Concern expressed by other players and/or officials about an athlete should trigger an immediate medical response.

# I TOOK THE PLEDGE.

## CONCUSSION AWARENESS WEEK



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## CONCUSSION ASSESSMENT DURING TRAINING OR MATCH PLAY

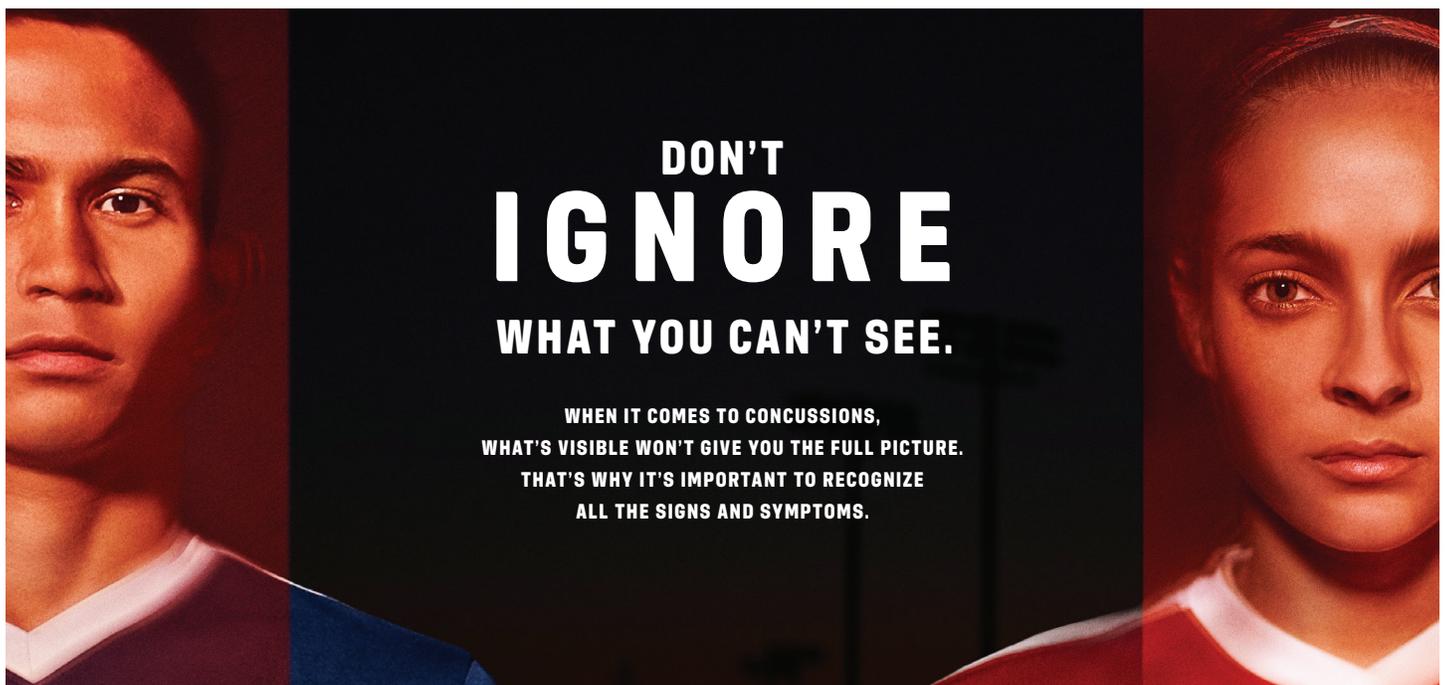
At the highest level of sport, a qualified medical provider (e.g., athletic trainer or physician) should be present at all conditioning sessions, practices and games. This individual is essential to not only the identification and management of concussion, but other orthopedic and general sports medical management conditions. It is recognized that support with personnel of this nature is highly dependent on resources, precluding their presence at all levels of participation.

Once removed from participation, the medical provider should initially screen for conditions requiring emergency intervention. The medical provider should consider activating the emergency action plan (EAP) and EMS transportation if any of the following, or other signs and symptoms of a life-threatening condition, are present:

<b>Neck pain at rest or that limits range of motion</b>	<b>Double vision</b>	<b>Weakness or tingling/burning in the arms or legs</b>	<b>Severe or worsening headache</b>	<b>Seizure or convulsion</b>
<b>Loss of consciousness</b>	<b>Deteriorating state of consciousness</b>	<b>Vomiting</b>	<b>Increasingly restless, agitated or combative behavior</b>	<b>Glasgow Coma Scale less than 13</b>

**In the event of the above conditions, transportation by personal vehicle should only be used as an absolute last resort when EMS services (or equivalent) are not available.**

Following removal from play and an evaluation to exclude life threatening injuries, the medical provider should evaluate the athlete for concussion.





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## HEAD INJURY ASSESSMENT SUBSTITUTION RULES

Should the injury occur during competition, the substitution guidelines below allow for the injury evaluation:

*Head Injury Substitution:* **Effective 2016**, U.S. Soccer has implemented a rule in its Development Academy league to allow substitution for a player who is suspected of suffering a head injury to be evaluated.

Under the Development Academy rule, the substitution for the evaluation of the concussion/head injury will not count against the team's total number of allowed substitutions/substitution moments in the game. However, a team must be in possession of at least one (1) substitution and one (1) substitution moment to implement this temporary substitution.

- Following an appropriate evaluation by an appropriately credentialed medical provider, accounting for potential delayed symptom development, if the player is deemed to not have suffered a concussion, the player may re-enter the game at any stoppage of play and must replace the original substitute; this head injury evaluation substitution will not count as a used substitution or substitution moment. Furthermore, the temporary substitute will be able to re-enter the game at a later time.
- If the player is not cleared to return to play by the medical professional, the replacement player will no longer be considered a temporary substitution.
- Any discipline issued to the temporary substitute will count for the remainder of the game



## PRE-SEASON CONCUSSION ASSESSMENT

The optimal concussion evaluation begins before the season, with a pre-season, pre-injury examination. As resources allow, on an annual basis all athletes should receive a comprehensive baseline concussion examination<sup>10</sup>, completed by a qualified medical provider (e.g., physician or athletic trainer) documenting the clinical examination for pre-injury factors known to influence concussion risk and recovery (e.g., concussion history). The baseline examination should also include an evaluation of multiple domains known to be affected by concussion; minimally comprised of assessments of cognitive functioning, motor control, and athlete-reported symptoms (additional detail follows). The medical provider should conduct this assessment in a supervised and quiet location that minimizes noise and distractions. Unsupervised testing (e.g., at home) is not permissible.



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## SCAT-5: SPORT CONCUSSION ASSESSMENT TOOL

Starting in 2005, an international group of sports medicine clinicians and researchers developed the Sport Concussion Assessment Tool (SCAT)<sup>11</sup>. Now in its fifth edition, the SCAT5<sup>12,13</sup> (see Appendix I) is available at no cost and provides a framework for a standardized concussion evaluation, encapsulating the clinical examination and assessments of cognitive functioning, motor control, and athlete-reported symptoms<sup>13</sup>. The SCAT5 can be used with athletes as young as 13. For those 12 years and younger, the SCAT5-Child<sup>14</sup> is available (see Appendix II) and is available at no cost.

# SCAT5<sup>©</sup>

## SPORT CONCUSSION ASSESSMENT TOOL – 5TH EDITION

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- Embedded within the SCAT5 is the Standardized Assessment of Concussion (SAC), a rapid cognitive screen shown to be highly sensitive to changes in cognitive function acutely after concussion with declining sensitivity beyond 72 hours post-injury.
- In settings with adequate resources, computerized assessments of cognitive functioning may be utilized in addition to the SAC. A number of tests are available for purchase and the medical team should select one that suits its needs based on resources, administration considerations, ease of information-sharing between medical providers, and experience. Those selecting what test(s) to implement should be mindful of the resources and personnel needed to both administer and interpret findings. Baseline testing with computer-based neurocognitive measures may be completed every other year after the age of 16.
- The motor control component of the SCAT5 is a modified Balance Error Scoring System (mBESS) evaluation. Minimal resources are needed to complete the mBESS, allowing it to be applied in all settings. The complete BESS requires a foam surface and may be used when resources are available.
- The SCAT5 also contains a 22-item symptom questionnaire that tracks symptom presence and severity on a zero to six scale. In this manner, a symptom evaluation can be completed at little to no cost, although some commercially available computerized neurocognitive tests also include a symptom assessment.
- The SCAT5 is but one tool to evaluate a potential concussion. Under no circumstances should anyone (medically credentialed or not) evaluating a potentially concussed athlete use an assessment tool in isolation to confirm or exclude a concussion diagnosis.





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## CONCUSSION RECOVERY AND RETURN TO ACTIVITY

Following a concussion diagnosis, an athlete should be removed from further sport participation with instructions to rest. Returning to play on the same day as a suspected concussion without appropriate medical clearance is now universally prohibited for all athletes by U.S. Soccer and by many state laws in youth cohorts<sup>18,19</sup>. Rest, typically lasting on the order of 24-48 hours, is defined as limiting the athlete to activities that do not exacerbate concussion-related symptoms. While this means removing the athlete from sport participation to reduce injury exacerbation, the medical provider may also consider temporarily modifying or limiting school (including physical education) and other activities if they provoke symptoms. Extended periods of “complete rest” (>5 days) and inactivity are not recommended<sup>20</sup>.



Returning to play on the same day as a suspected concussion without appropriate medical clearance is now universally prohibited for all athletes by U.S. Soccer and by many state laws in youth cohorts [18, 19].

Despite advances in post-injury management, the recovery process is highly individualized and largely guided by the athlete’s report of concussion-related symptoms associated with progression through each stage of return to pitch. Progression through the return-to-sport protocol should be conservative and concussion-related symptoms (type and severity) should be monitored and documented before and after each stage. In the majority of cases, medical providers should separate each step by one day, with the time to complete the full protocol lasting approximately one week. Longer stage-to-stage intervals may be implemented at the discretion of the medical provider. Furthermore, the decision to return an athlete to unrestricted participation must not only include the player’s ability to complete each stage of the protocol, but a comprehensive (e.g., physical and emotional) evaluation of their readiness.



Progression from Stage 1 to 2 does not require the athlete be completely asymptomatic (i.e., absence of all symptoms), accounting for pre-injury levels of nonspecific symptomatology; rather, all new concussion-related symptoms should be resolved for progression to occur. Indeed, emerging evidence shows that light aerobic activity prior to full symptom resolution may help reduce symptom burden and time loss<sup>20,21</sup>, but the literature at the time of writing has not elucidated the optimal timing, intensity, or duration of such aerobic activity. In all instances however, progression through the return to pitch process should be halted for those experiencing a symptom increase during or following activity at any given stage until acute concussion-related symptoms resolve and the athlete can tolerate activities for a given stage without symptom exacerbation.



**SUGGESTED RETURN TO PITCH PROTOCOL\***

STAGE	AIM	ACTIVITY
1	Symptom limited	Daily activities that do not provoke symptoms (e.g., walking or light stationary bike)
2	Light aerobic exercise	<p>a. Cardiovascular: Controlled activities of low to moderate intensity on stationary bike (25-40min) including warmup and cool-down</p> <p>b. Body training: Mobility/stretching and balance exercises</p>
3	Soccer specific (non-contact)	<p>a. Cardiovascular: On field training with 10min warmup at moderate intensity with variable running tasks; Interval runs at higher intensity with sufficient rest; 5-10min cool down</p> <p>b. Technical training: 1:1 technical training with the ball; balance and passing; short/long passing; easy shooting on targets</p> <p>c. Body training: No resistance progressing to elastic resistance, mobility and stretching exercises, trunk strength/stabilization exercises (no resistance or explosive movements), basic lower/upper extremity strength exercises (elastic resistance), balance exercises (double and single stance) on unstable surfaces</p> <p>No heavy resistance training or contact activities Goalkeepers: controlled diving activities (not explosive) on foam surface in gym and without a ball</p>
4a	Non-contact soccer training drills	<p>a. Cardiovascular: On field training with 10min warm up at moderate intensity with straight running, direction changes, lateral shuffles, forward/backward and zig-zag running, interval runs at high intensity up to 90%max HR, 5-10min cool down</p> <p>b. Technical training: non-contact with small group of players, small size game, short/long passing, goal/target shooting, plant/cut and dribble with ball, basics: easy soft ball heading with increasing complexity (add balance component) in a controlled setting and limited quantity</p> <p>c. Body training: Elastic resistance, mobility and stretching exercises, trunk strength/stabilization exercises (progressing to free weights), basic lower/upper extremity strength exercises (elastic resistance progressing to free weights), balance exercises (single/double stance) on unstable surfaces</p> <p>d. Strength training: &lt;80%1 RM, no classic weight lifting or exercises with head below the hips (e.g. back extensions on the bench), progressively increase external resistance for multi-joint exercise</p> <p>No contact activities Goalkeepers: controlled diving activities with and without a ball (shots from short/medium range, 1:1 with coach)</p>
4b	Controlled contact soccer training drills	<p>Following medical clearance, controlled contact activities that simulate controlled contact situations (e.g., headers, checks, tackles), progressive increase in intensity, progressing from player with one partner (e.g. medical personnel) to training with small groups, progressing from small playing field (1/3, 1/2) to full field, limited number of headers with regular ball in controlled settings (e.g., thrown ball, heading without opponent)</p> <p>Goalkeepers: controlled diving drills on grass without and with ball catching (shots from short/medium/long range; 1:1 with coach)</p>
5	Full contact team soccer training	<p>Following medical clearance, normal team training participation; Continue</p> <p>c. Cardiovascular training continues</p> <p>d. Body training: Return to routine strength training (unrestricted)</p> <p>e. Assess and assure psychological readiness</p>
6	Return to Soccer	Normal game play

\* Feddermann-Demont N, Chiampas G, Cowie CM, Meyer T, Nordström A, Putukian M, Straumann D, Kramer E, Initial examination, differential diagnosis and management of head injuries in high-level football, British Journal of Sports Medicine (in review)



## SUGGESTED RETURN TO SCHOOL PROTOCOL†

STAGE	AIM	ACTIVITY
1	Daily activities at home that do not provoke symptoms	Typical activities of the child during the day as long as they do not increase symptoms (e.g., reading, texting, screen time). Start with 5–15 min at a time and gradually increase
2	School activities	Homework, reading or other cognitive activities outside of the classroom
3	Return to school part-time	Gradual introduction of schoolwork. May need to start with a partial school day or with breaks during the day
4	Return to school full-time	Gradually progress school activities until a full day can be tolerated

## SPECIALISTS

Although the natural history of concussion is not well defined among a number of cohorts, spontaneous injury resolution and full return to play can be anticipated among half of concussed athletes within 14 days in young adults and 28 days in children. International guidelines suggest that young adults experiencing concussion related symptoms beyond 14 days (or > 1 month among children) should be referred to a qualified health care provider at the behest of the coordinating physician, based on the clinical presentation. Specific interventions will need to be made on a case-by-case basis, but exercise<sup>21</sup>, visual or vestibular rehabilitation<sup>22</sup>, cervical spine therapy<sup>22</sup>, and cognitive behavioral therapy<sup>23</sup> may all have benefits.

## DOCUMENTATION

Athletic trainers, team physicians, and other health care providers should maintain accurate, complete, and legible documentation to help ensure the health and safety of the athlete throughout the course of care, beginning before and continuing after injury, through recovery and return to full activity. Indeed, sports medicine clinicians should document all of their interactions, clinical recommendations, and findings starting with the pre-injury evaluation.

While documentation is standard practice among medical providers, the National Athletic Trainers’ Association<sup>15</sup> has advised that clinicians document “all pertinent information surrounding the concussive injury.” This includes (1) mechanism of injury, (2) initial signs and symptoms, (3) state of consciousness, (4)



findings on serial testing of symptoms and neuropsychological function and postural-stability tests, (5) instructions given to the athlete and/or parent, (6) recommendations provided by the physician, (7) date and time of the athlete’s return to participation, and (8) relevant information on the player’s history of prior concussion and associated recovery pattern(s).

Thus, for example, during an athlete’s return-to-play progression, daily, accurate, and detailed documentation surrounding the athlete’s progression through the protocol is recommended. Understanding that field restrictions might limit the ability to document right away when an athlete is first evaluated, most documentation may happen afterwards. However, it is important that the documentation accurately reflect all perceived signs and symptoms in order to help the athlete progress along the recovery process. The medical notes should document the dates on which the testing was performed, supervision of the testing, and the specific maneuvers performed. While this level of attention to detail may be viewed as laborious or challenging to achieve, such documentation is helpful in the event any questions arise regarding the care provided.

†adapted from McCrory et al<sup>2</sup>



## RISK REDUCTION

All sport participation carries risk for multiple injuries, including concussion, necessitating the need for medical providers and team officials to prioritize risk reduction. The voluminous number of tools and techniques intended to reduce or eliminate concussion risk preclude comprehensive evaluation here in this document, but the following were appraised:

### Heading

There is an absence of literature addressing the relationship between restricting heading to those of a certain age and concussion risk, but reducing opportunities for aerial challenges, and thus head-to-head contact, is intuitive to both concussion and orthopedic injury risk reduction.



### Mouthguards

The evaluation of mouthguards specific to concussion risk in soccer has not been addressed in the literature, but a systematic review<sup>24</sup> and a meta-analysis<sup>25</sup> across multiple sports showed a non-significant reduction in concussion risk. The use of mouthguards is supported to prevent dental and facial injuries.



### Neck strength

Increasing neck strength has been shown to reduce post-head impact linear and rotational accelerations<sup>26</sup> and overall concussion risk<sup>27</sup>. While this approach will not prevent all injuries, implementation of specific neck strengthening exercises to a full body strength and conditioning program is not likely harmful and may have some benefit.



### Soccer-specific headgear

Soccer headgear was examined among youth athletes with no difference in concussion risk across five models<sup>28</sup>. The use of soccer headgear specifically to reduce concussion risk is not supported at this time.



## OTHER

A number of additional injury assessments and identification and recovery techniques are available to the clinician and were considered by the panel. While not included in this document, their inclusion or exclusion will be considered in the next iteration based on the scientific literature. Until that time, medical providers may consider their use as resources permit.

This document is to be reviewed and revised in 2021.



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