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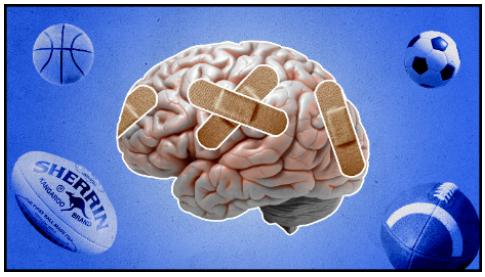
VANDERBILT SPORT CONCUSSION CENTER
QUARTERLY NEWSLETTER
Fall 2025

Acute Sleep Disturbances and Recovery Outcomes after Sport-Related Concussion

Can Acute Sleep Disruptions Impact Recovery Timelines?

Heads Up Concussion

Defining Sport-Related Concussion Injury and Reviewing Clinically Accepted Recovery Guidelines.



Providers Spotlight

This issue's spotlight features Dr. Alex Diamond, DO, MPH, FAAP, FAMSSM, CAQSM

Research Corner

Check out some of the latest work being done in the Vanderbilt Sports Concussion Center!

Student Spotlight

Our student spotlight highlights Meharry Medical Student, Jai Horsey.

Mechanism of Injury in Basketball Concussions

See Our Review of Literature Surrounding Sport-Related Concussion in Basketball.

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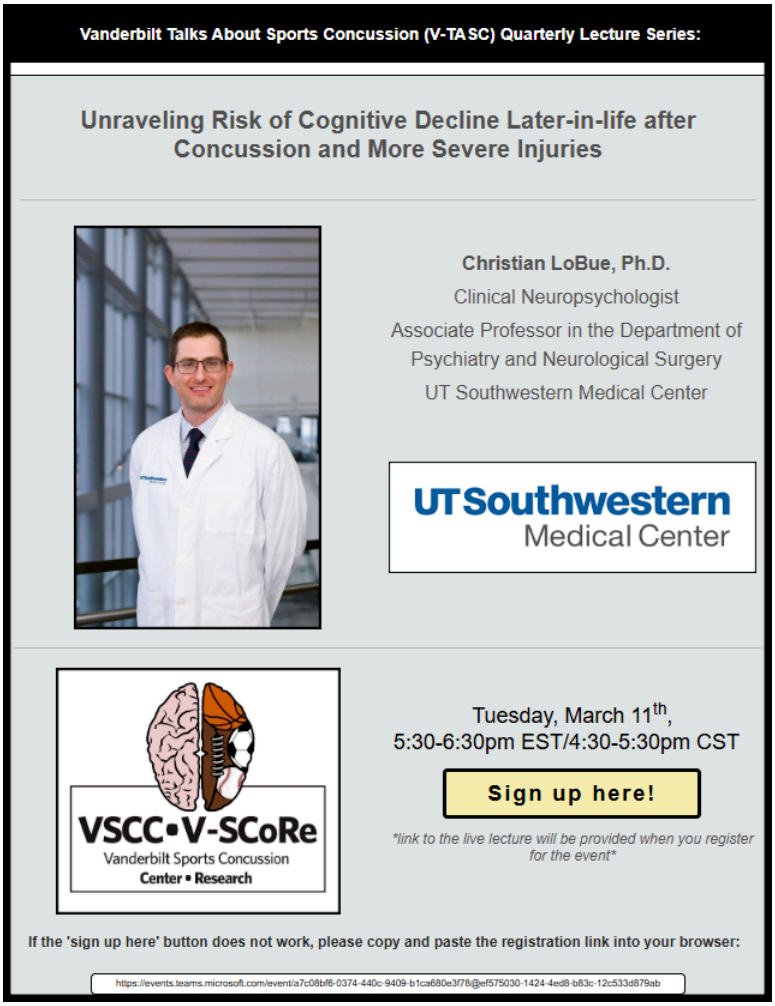
Recent Events

V-TASC Lecture
Our most recent quarterly lecture series featured speaker Dr. Christian LoBue, Ph.D.
here



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Co-Directors' Message

As fall sports kick off across Middle Tennessee and beyond, the Vanderbilt Sports Concussion Center is proud to continue providing comprehensive, evidence-based care for athletes of all ages who sustain concussions. Our team of specialists works closely with patients and families to guide recovery, drawing on the latest science and a truly multidisciplinary approach. Whether on the sidelines, in clinic, or in collaboration with coaches and trainers, we remain committed to ensuring safe return to play, return to school, and return to life.

Alongside patient care, our center continues to advance concussion research that shapes both local practice and national policy. This fall, our studies are focusing on better ways to identify concussions early, understand why some athletes recover more slowly, and evaluate strategies to protect players before injuries happen. We are energized by the season ahead—not only cheering on our local athletes, but also working to make sports safer for everyone who takes the field.

From your co-directors -
Scott, Doug, and Andrew

Acute Sleep Disturbances and Recovery Outcomes After Sport-Related Concussion

Jackson Scarbrough

Recovery from a sport-related concussion (SRC) can take on many forms. Injured athletes can experience a diverse mix of physical, cognitive, and emotional symptoms following a concussion.[1] Sleep disturbances (e.g., insomnia or hypersomnia) are common following a concussion,[2] and previous work has shown that up to 70% of concussed athletes will report sleep issues during recovery.[3] Given that sleep is a critical process in neurological recovery,[4] it is vital to understand how disturbances in sleep may arise after concussion and how these disturbances will impact subsequent recovery. These considerations are particularly important for adolescent athletes. Several estimates indicate that around 20-40% of a general, healthy adolescent population may face sleep difficulties,[5] likely stemming from multiple

Our findings suggest that athletes who reported acute sleep-related symptoms had significantly longer times to RTL (median of 4 vs. 3 days), SR (median of 15 vs. 8 days), and RTP (median of 16 vs. 13 days) than those without sleep symptoms. More advanced analyses also found similar recovery delays in the sleep symptoms group, yet only *time to RTL* was statistically significant. However, when taking other important variables into account, acute sleep initiation symptoms were not a predictor of recovery outcomes. Our results indicated that while acute sleep symptoms may influence concussion recovery, their impact may be eclipsed by other variables, such as biological sex, total number of lifetime concussions, and a family history of ADHD/learning disorder (LD).

recovery may thus offer valuable clinical insight into the most beneficial treatment strategies for an injured athlete.

Previous research has suggested that sleep disturbances can impact severity and persistence of concussion symptoms, sleep quality and quantity, and overall recovery time.[3] However, the scope of these studies often encompasses days or weeks of analysis and fails to measure how *acute* sleep symptoms—measured within the first 72 hours of injury—may influence recovery timelines. Understanding the short-term impact of sleep disturbances on SRC recovery can inform clinicians on the best mitigation approaches during a critical time window following injury. A recent study in our lab from De Oliveira et al.[6] aimed to fill this gap by examining how the presence of acute sleep symptoms impacts three common recovery metrics: return-to-learn (RTL), return-to-play (RTP), and symptom resolution (SR).

In a retrospective cohort study of 116 adolescent athletes who visited our regional sports concussion center within three days of initial injury, we examined whether reporting *any* sleep initiation symptoms would impact a patient's *time to RTL, time to RTP,* or *time to SR*. Of the 116 athletes in our cohort, 29 (25%) reported sleep initiation symptoms while 87 did not.

disturbances and recovery following an SRC, particularly within an adolescent athlete population. More work on this relationship will refine clinical treatment of sleep disturbances post-concussion, especially in the recommendation of various sleep hygiene techniques. For example, limiting screen use before bed is a simple and effective strategy for relieving acute sleep disturbances. Given that adolescents in the United States already spend nearly a third of the day using screens,[7] this intervention could be particularly beneficial in this population. The effectiveness of other strategies, such as melatonin use, cognitive behavioral therapy for insomnia (CBT-I), and light therapy, remains to be thoroughly studied. Examining these interventions, as well as providing additional data on acute sleep disturbances and recovery outcomes, will continue to improve clinical insight and foster reliable, evidence-based treatment strategies.

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7. Macnow T, Curran T, Tolliday C, et al. Effect of Screen Time on Recovery From Concussion: A Randomized Clinical Trial. *JAMA Pediatr*. 2021;175(11):1124. doi:10.1001/jamapediatrics.2021.2782

Dr. Diamond, DO, MPH, FAAP, FAMSSM, CAQSM

We are honored to highlight Dr. Alex Diamond in this issues provider spotlight. Dr. Diamond is a pediatric sports medicine physician at Vanderbilt University Medical Center and is a Team Physician for Vanderbilt University and the Nashville Predators, as well as several area high schools. Dr. Diamond is the Director of the Vanderbilt Youth Sports Health Center, as well as a professor of Orthopaedic Surgery, Pediatrics, and Neurological Surgery.
Our own Kristen Williams (KW) had the opportunity to sit down and hear about Dr. Diamond's time at Vanderbilt and his experience with treating concussion.

KW: Can you tell us about some of the research you are doing?

AD: *"My research work focuses on injury prevention and the promotion of health and safety in youth sports. A lot of what I'm doing currently involves the evaluation of our Safe Stars program here in Tennessee."* *click here to learn more about Safe Stars*

KW: How have you seen concussion care evolve since the beginning of your career?

AD: *"Tremendously. I've seen it go from something that was not given a lot of consideration - then it swung to the idea of cocooning - then it swung again to where we are now which is really exciting in that concussion is no longer just this 'wait and see' process but something that we can actively treat like a knee or shoulder injury. I think also the recognition of the need for personalized care and tailoring our treatments to the individual patient's concussion phenotype has been some really impactful changes. When I was a fellow we MAYBE saw 3 patients for a concussion in the clinic the whole year. Now I often regularly see 3 in a single morning."*

KW: What is one thing about caring for sport-related concussions in athletes you would like the public to know?

AD: *"Despite the incredible advances over the past 2 decades, we still have a long way to go and I'm optimistic that with the work of the VSCC we will have better science to guide our concussion diagnosis, treatment, and hopefully one day prevention."*

KW: How have you seen the VSCC change, and where do you see us going in the future?

AD: *"I think the word evolve is probably more appropriate. I've been here since the beginning of the VSCC and having seen what Dr. Sills, Dr. Solomon and Dr. Gregory created from scratch emerge into one of the leading centers in the country is just remarkable. It really speaks to who they are as people and their hard work, vision and leadership. It's been really exciting to see Dr. Terry and Dr. Zuckerman come in and embrace what the center can do from a clinical, research and education perspective and lead us into the next phase. Having the multi-disciplinary care and expertise across the health system is just such a tremendous benefit."*

KW: If you could choose 3 words to describe your approach to caring for athletes with concussion, what would they be?

AD: *"Compassionate, individualized, balanced."*

About Me:

Dr. Diamond received his undergraduate degree from Duke in Sociology, he went on to earn his doctorate from the Philadelphia College of Osteopathic Medicine and then completed a residency in pediatrics at St. Christopher's Hospital for Children. During his 2nd year of residency, he attended a sports medicine conference and heard Dr. Gregory give a podium presentation - he was so impressed that he approached Dr. Gregory after to see if he could come to Vanderbilt as a visiting resident. He was then able to spend a month with the Vanderbilt sports medicine team. "*I knew right away that what they did was exactly what I wanted to do, and Vanderbilt was the place I wanted to do it.*" Dr. Diamond matched at Vanderbilt later that year (2007) for a fellowship and has been here ever since. "*Vanderbilt is a very collaborative place with great people. That is what attracted me initially to come here and has certainly kept me here over the years*."

Dr. Diamond is originally from Pottsville, PA, a small coal mining town in northeastern Pennsylvania. He was 4th generation in his family to live there. He now lives in Lebanon, TN, with his wife Connie, his daughter Evie, and son Evin. Dr. Diamond enjoys spending time with his family and being out on their land. He and his wife love to hike and listen to music. He also helps coach his children's sports, Evie plays volleyball and Evin plays basketball.

Mechanism of Injury in Basketball Concussions

Nicholas Firestone

Originally developed to keep football and baseball players in shape during the off-season, basketball has evolved to become one of the world's most popular sports.[1] In the United States, an estimated 28.1 million people ages 6 and up play basketball, with more than 800,000 being high school athletes.[2,3]

Basketball is a contact sport in which impact with other players or objects is often inevitable. Defenders use physical contact to disrupt offensive players, and offensive players use their bodies to create space and shield the ball.[4] Although basketball involves less contact and force of impact than collision sports like football or hockey, injuries are still common.[5] A recent study showed that among pediatric basketball players, concussion and head-related injuries account for 9.4% of the basketball injuries encountered, making it the third leading cause of injury after ankle sprains (17.4%) and finger injuries (12.4%).[6] Despite basketball's popularity, concussion research focused on the sport has received less attention than in collision sports. More specifically, there is limited research on specific mechanisms that may be causing concussions and/or head injuries on the court.

Research into mechanisms of injury for sport-related concussion (SRC) has garnered interest as a means of possible injury prevention.[7] Prevalence and incidence of specific mechanisms vary with different sports. Although mechanisms have been studied, very few studies have investigated their impact on injury severity or recovery in basketball-related SRC. A recent study by Bishay et al, examined the mechanism of injury for concussed high school basketball players and its impact on initial symptom presentation and recovery.[8]

Study Overview and Key Findings:

This pilot study retrospectively analyzed data from a cohort of 105 concussed high school basketball players. The aim was to describe the mechanisms of injury that occur in basketball and assess relationships between individual mechanisms and symptomatology measured by the Post Concussion Symptom Scale (PCSS), and time to recover measured by symptom resolution (SR), return-to-learn (RTL), symptom resolution (SR), and return-to-play (RTP).

Head-to-ground impact was the most common type of injury mechanism (41.9%). The most common individual mechanism of injury was taking a charge (22.6%).	Concussions occurred at nearly equal rates on offense (45.3%) and defense (43.4%).	Head-to-body contact was associated with higher symptom scores than both head-to-head ((β = 0.33, P = .003) and head-to-ground (β = 0.23, P = .050).	Higher initial symptom burden was the only factor associated with longer RTL, SR, and RTP.

The study's findings suggest a need for further research in this field. There is an opportunity for future studies to take advantage of video review methodology for mechanism categorization that may help limit any bias present from athlete's self-reporting. Given that the only contact mechanism associated with higher initial symptom severity was head-to-body, this injury mechanism warrants further study. For instance, symptom severity and recovery time may vary between an impact with another player's torso and an impact with another player's elbow.

In basketball, a charge is a type of offensive foul called when an offensive player, with or without the ball, makes illegal contact with a stationary defensive player who has established a legal guarding position. Drawing a charge is an important defensive strategy to stop offensive players from moving closer to the basket and results in a change of possession. Greater emphasis should be placed on charge-taking technique in practice, as this was the most common individual mechanism of concussion. Improved training on safe charge-taking techniques, along with rule changes that discourage aggressive contact, may help reduce risk of concussions in the future.

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8. Bishay AE, Albert AN, Rigney GH, et al. Does Mechanism of Injury Affect Recovery After Sport-Related Concussion in Basketball? A Pilot Study. *Neurosurgery*. 2025;96(4):850-859. doi:10.1227/neu.0000000000003175

Research Corner

We would like to take a moment to recognize the work that our team has accomplished over the last few months and share a few of our recently accepted manuscripts as well as those projects accepted for the Congress of Neurological Surgeons (CNS) 2025 Conference.

Congratulations to all authors!

Click the link to access the full-length article.

Recent Manuscripts

Evaluation of sport-related concussion using objective eye tracking. Bishay AE, Williams KL, De Oliviera N, Fitch SW, Hong E, Zuckerman SL, Terry DP. 2025. *Brain Injury.*

Return-to-learn following sport-related concussion: a systematic review. Bishay AE, Jallow O, Jo J, Williams K, Hong E, Allen J, Zuckerman SL, Terry DP. 2025. *Journal of Neurosurgery Pediatrics.*

Atypical Symptoms Following Concussion: A Comprehensive Review of Functional Deficits. Bishay AE, Hughes NC, Albert AN, Dugan JE, De Oliveira N, Williams KL, Zuckerman SL, Terry DP. 2025. *Archives of Clinical Neuropsychology.*

Long-Term Brain Health Outcomes in Females With a History of Contact Sports: A Cross-Sectional Survey Analysis. Rigney GH, Dugan JE, Bishay AE, Jo J, Jonzzon S, Williams KL, Zuckerman SL, Terry DP. 2025. *Clinical Journal of Sports Medicine.*

The Association Between Age of First Exposure to American Football at a Young Age and Later-Life Health Issues in Healthy, Community-Dwelling Adults. Rigney GH, Dugan JE, Bishay A, Jonzzon S, Jo J, Williams KL, Zuckerman SL, Terry DP. 2025. *Clinical Journal of Sports Medicine.*

Does the presence of acute sleep initiation symptoms impact recovery from sport-related concussion? De Oliveira N, Horsey J, Vanleuven J, Williams KL, Zuckerman SL, Terry DP. 2025. *Brain Injury.*

College of Neurological Surgeons 2025 Project Acceptance

Long-term Outcomes After Sport-Related Concussion: Are College, Employment, And Income At Risk? Jai L. Horsey, Anthony E. Bishay, Kristen Williams, Avi Albert, Samuel W. Fitch, Tyler Sills, Olivia Shaffer, Scott L. Zuckerman, Douglas P. Terry.

October 13th, 2025, 7:00AM-7:06AM

Oral Presentation #212

Delayed Learning: The Effect of Missed School on Academic Performance After Adolescent Sport-Related Concussion. Daytawn Campbell, Jai Horsey, Nia C. Boles, Kailyn Hayes, Anna J. Peterson, Kristen L. Williams, Scott L. Zuckerman, Douglas P. Terry

October 14th, 2025

Printed Poster #4065

Does Age Of First Concussion Predict Later-Life Psychological Or Neurocognitive Symptoms? Jai L. Horsey, Grant H. Rigney, Kristen L. Williams, Scott L. Zuckerman, Douglas P. Terry, PhD

Digital Poster #6868

Screen Use And Recovery Times Following A Concussion: A Scoping Review. Jai L. Horsey, Anna J. Peterson, Campbell Coleman, Kailyn D. Hayes, Lucy Van der Reis, Keen Zoller, Olivia Shaffer, Kristen L. Williams, Scott L. Zuckerman, Douglas P. Terry

Digital Poster #6752

Student Spotlight: Jai Horsey

Jai Horsey is a fourth-year medical student at Meharry Medical College and has worked with the Vanderbilt Sports Concussion Center (VSCC) since his second year in medical school. Jai recently completed a year of dedicated research time with the VSCC after receiving the Vanderbilt University School of Medicine Medical Scholars Program Fellowship, which allows him to collaborate on research projects full-time for one year. Jai plans to become a neurosurgeon and is considering neurotrauma as a sub-specialty. Our own Kristen Williams (KW) sat down with Jai to learn more about his experiences with V-SCoRe.

KW: Why did you want to get involved with V-SCoRe?
JH: "A former Meharry graduate expressed how valuable his relationship was with Dr. Zuckerman in his pursuit of neurosurgery. After being introduced to Dr. Zuckerman, I shortly realized how much of an amazing mentor he was, and I also grew to be more passionate about the work VSCC did."

KW: How has V-SCoRe impacted your education?
JH: "This research group has impacted my education in several ways. First, my research skills and critical thinking have tremendously improved, and this will serve me well as a future academic physician. Next, I have learned about other realms related to a career in neurosurgery, which has allowed me to be more open-minded about my career options. Lastly, the lasting relationships I have fostered have reinforced my values of collaboration and mentorship."

KW: What is something valuable that you've learned about concussions?
JH: "I've learned that all concussions are not the same and that a patient's recovery is multi-faceted. This is important to me as it shows how, as providers, we must first consider individual nuances and variability, especially in social"

KW: What is the most valuable thing you *have learned so far working with V-SCoRe?*
JH: "The most valuable thing I've learned is that CTE cannot be diagnosed until post-mortem. I found this valuable because of current media perceptions around the topic, but this has put the diagnosis into greater perspective when we discuss how head impacts influence athlete health later in life.

Fun Facts

KW: What is something about you outside of medicine/science?

JH: "I love to exercise and recently got interested in doing Muay Thai."

Growing up, Jai played baseball, football and ran track.

VSCC Projects

College Football Mouthguard Study / Guardian Cap Usage
-Jai assisted with managing instrumented mouthguards within the Vanderbilt University Football Team. One aim of this research is to examine the impact that Guardian Caps may have on head impact kinematics in collegiate

Long-Term Follow Up of Concussion Patients
-This survey study was sent to athletes evaluated in our concussion clinic several years after their sport-related concussion. Specific study aims relate to 1)long-term socioeconomics, 2)prolonged concussion recovery and long-term mental health, 3)initial concussion severity and long-term mental health, and 4) age of first concussion and long-term mental health.

Use of Wearable Fitness Trackers
-A prospective study collecting how much activity and sleep athletes get following a concussion using a Fitbit, and related these variables with how long it takes to recover from concussion.

Screen Time and Concussion Recovery
-Prospective study evaluating the impact of screen time on concussion recovery.

Area Deprivation Index (ADI)
-Does one's socio-economic status impact concussion presentation times.

Nutrition and Concussion
-Does nutrition impact the risk, severity, or recovery following a sport-related concussion?

Mechanism of Injury and Recovery
-This study examines the mechanism of injury for concussion in volleyball players and the impact on recovery outcomes.

Publications

Comparative Analysis of Sport-Related Concussion: How Do 8- to 12-Year-OldAthletes Differ from 13- to 17-Year-Old Athletes

Does the presence of acute sleep initiation symptoms impact recovery from sport-related concussion?

Heads Up Concussion: Defining Sport-Related Concussion Injury and Reviewing Clinically Accepted Recovery Guidelines

Nia C. Boles

Sport-related concussion (SRC) injury is common amongst high school and collegiate athletes with many students reporting sustaining more than one injury throughout their lifetimes. [1]

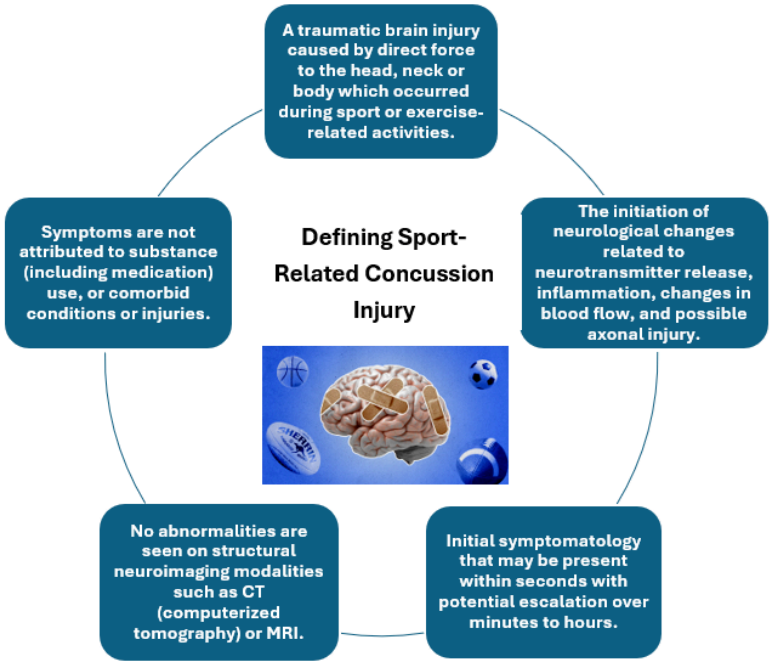

Figure 1: The conceptual definition of SRC as outlined by the Concussion in Sport Group's (CISG) 6th International Conference, held in Amsterdam in October 2022.[2]

Common symptoms experienced in the post-concussion period include headache, visual

imperative for high school and collegiate athletes to adhere to such recommendations outlined by their provider and athletic trainer, as proper recovery following injury can prevent future neurological disturbances.

Physical Activity

In previous decades, it has been thought that restriction from all physical activity following sport-related concussion was crucial to aid in recovery; however, several studies have shown that light physical activity, such as swimming, jogging, or cycling, in the first 48 hours following injury can facilitate recovery.[5] Specifically, Lawrence et al. found that aerobic exercise, either self-initiated or physician-prescribed, as early as 1 day following SRC was associated with faster recovery than when exercise was initiated 3, 5, 7, or 14 days after injury.[5]

Return To Learning

According to the Center for Disease Control (CDC) and Nationwide Children's Hospital, students are recommended to return to school within two days post-concussion.[6] However, these guidelines may be influenced by factors such as symptom severity, prior number of concussions, pre-injury conditions such as psychological disorders, ADHD, or a migraine disorder. While students may return to school soon after their concussion, many students subsequently receive academic accommodations such as shorter school days, extended time to complete tests/assignments, or extended rest periods throughout the school day.[7]

Screentime Use

Studies have shown that limiting screentime use (eg, phones, computers) in the first 48 hours after sport-related concussion can help facilitate recovery.[8] In a randomized controlled trial conducted by Macnow et al., researchers found that in 91 patients randomized to either the screen time permitted or the screen time abstinent group, the screen time permitted group had a significantly longer median recovery time of 8.0 days compared with 3.5 days (p=.03) in the screen time abstinent group.[9]

Conclusion

Sport-related concussion injury has been a widely studied field, and while understanding clinically accepted guidelines can aid in a patient's recovery, athletes are always advised to adhere to the treatment plan discussed by their health care provider. Differences in initial injury severity, symptom burden, and recovery trajectory all play a role in how an athlete returns to sports after sustaining a SRC.

Heads Up: What to do next?

"*I continued playing after sustaining a direct blow to my head and neck, now I feel 'off.' What should I do*?"

You may have sustained a sport-related concussion. Inform your parents, coach, and athletic trainer who should advise you to stop playing, and visit your health care provider

"I've been cleared to return to play, however, I am having persistent concussive symptoms."

Inform your coach, athletic trainer, and health care provider. During the return to play process, regressions can occur for patients who were once asymptomatic. You may need additional time to recover and/or additional treatments.

"I feel ready to return-to-school but I'm struggling with symptom exacerbations throughout the day."

Engage in an open and honest conversation with your teachers and health care providers who may be able to provide academic support and/or accommodations

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2. Patricios JS, Schneider KJ, Dvorak J, et al. Consensus statement on concussion in sport: the 6th International Conference on Concussion in Sport–Amsterdam, October 2022. *Br J Sports Med*. 2023;57(11):695-711. doi:10.1136/bjsports-2023-106898

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Look for our next Newsletter Spring 2026!

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If you have any questions about the VSCC Quarterly Newsletter, please reach out vscc@vumc.org