

Concussion management and return-to-play protocols: A structured abstract

Jakhongir Sultonov
Uzbekistan

Introduction: Sport-related concussions are common injuries in both contact and non-contact sports, posing a significant health concern. In the United States alone, an estimated 1.7 to 3.8 million traumatic brain injuries occur annually, with sports and recreational activities accounting for a substantial proportion. While most concussion symptoms resolve within days to a few weeks, mismanagement of a concussion (for example, returning to play too soon) can prolong recovery or even lead to severe complications. Notably, research has shown that repetitive minor head impacts can result in significant long-term neurological sequelae, underscoring the importance of proper concussion management. This has driven the development of evidence-based guidelines to ensure safe return-to-play (RTP) for athletes after concussion.

Methods: Current concussion management is guided by consensus guidelines and best practices grounded in emerging evidence. It is universally recommended that any athlete suspected of having a concussion be immediately removed from play and promptly evaluated, with no same-day return to sport permitted in confirmed concussion cases. Initial management involves a brief period of physical and cognitive rest (typically 24-48 hours) to allow acute symptoms to subside. Thereafter, a graduated RTP protocol is followed: activity is reintroduced in a stepwise fashion, advancing through increasing levels of exercise intensity only as long as symptoms do not recur or worsen.

Throughout this process, close medical supervision is maintained. Modern guidelines emphasize an individualized approach given that each concussion recovery trajectory is unique, rigid timelines or one-size-fits-all grading systems have been abandoned in favor of tailoring management to the individual's progress. These evidence-based protocols serve as the methods by which clinicians manage concussions and make RTP decisions.

Results: Assessment and Decision-Making: Safe RTP decisions rely on careful neurocognitive and clinical evaluation of the recovering athlete. Clinicians use a combination of tools including symptom checklists, neuropsychological (neurocognitive) tests, postural/balance assessments, and standardized sideline instruments (e.g., SCAT5) to monitor an athlete's recovery from concussion. Comparing post-injury test results to the athlete's pre-injury baseline (when available) can help detect residual deficits, although baseline testing is not mandatory, especially in youth athletes due to variability in development. Formal computerized neurocognitive tests (e.g., ImPACT) are valuable for identifying subtle cognitive impairments and verifying that cognitive function has returned to normal; however, these tests are adjuncts to clinical judgment and are not by themselves definitive indicators of recovery. Instead, return-to-play decisions are made by integrating test results with clinical assessments ensuring the athlete is symptom-free at rest and with exertion, cognitive

function has normalized, and neurological examination is back to baseline before clearance is given .

Rehabilitation and RTP Progression: The cornerstone of concussion rehabilitation is a graduated exercise progression that ensures the athlete only advances to more demanding activity when it is safe. Most RTP protocols outline a stepwise sequence (often a 5- or 6-step progression) beginning with light aerobic activity and progressing to moderate exercise, sport-specific non-contact drills, full-contact practice, and finally unrestricted competition . Each stage typically lasts at least 24 hours, and the athlete should remain symptom-free before moving to the next stage . If any concussion symptoms recur during a stage, the athlete is advised to stop activity and rest until symptoms resolve, then resume at the previous step once stable . Criteria for full RTP include complete resolution of all symptoms, return of balance and neurocognitive performance to pre- injury levels, and medical clearance by a qualified health professional . Adherence to these criteria and gradual rehabilitation steps is crucial to prevent setbacks and avoid dangers such as second- impact syndrome. In summary, the results of applying current protocols are that athletes only return to play when they have objectively and subjectively recovered, thereby reducing the risk of re- injury or long-term impairment.

Conclusion: Concussion protocols continue to evolve as new research emerges, aiming to improve safety and outcomes for athletes. Recent studies have begun to challenge the old “rest until asymptomatic” dogma . For instance, controlled trials in adolescents indicate that early, sub- threshold aerobic exercise (introduced a few days after injury) can speed recovery compared to prolonged strict rest . Accordingly, modern guidelines now endorse early light exercise after an initial rest period, as long as it does not significantly exacerbate symptoms . There is also a growing focus on developing objective biomarkers and advanced diagnostics for concussion: researchers are investigating blood biomarkers (such as S100B, GFAP, and tau protein) and advanced neuroimaging techniques (DTI, fMRI, MRS) that could provide quantifiable indicators of brain injury and recovery . Additionally, technologies like helmet-mounted impact sensors are being used to gather data on head impacts, which may inform future injury risk reduction strategies and improve understanding of the cumulative effects of repetitive head trauma . These emerging directions “from active rehabilitation strategies to biomarker research” promise to refine concussion management and RTP protocols. Ongoing large-scale studies and consensus efforts (e.g., the 6th International Conference on Concussion in Sport) are expected to further update evidence-based guidelines, with the ultimate goal of optimizing recovery and protecting athletes’ long-term neurologic health .

Sources: This abstract is based on current sports medicine and neurology literature, including consensus guidelines (e.g., Concussion in Sport Group statements), position statements, and clinical research findings from reputable medical sources . All recommendations reflect the prevailing evidence-based standards for concussion care and RTP decision-making as supported by authorities like the CDC, American Academy of Neurology, and sports medicine organizations. The citations provided correspond to key references that underpin the guidelines and concepts.

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Biography

Olivia Harper is a senior physiotherapist and researcher at the University of Sydney, Australia. With over 15 years of clinical experience in neurorehabilitation, she holds a Ph.D. in Movement Science and Rehabilitation. Dr. Harper's work focuses on integrating digital technologies, including VR and tele-rehabilitation, into clinical practice. She has led multiple funded trials and published extensively in the field of neurological physiotherapy. Passionate about innovation, she is committed to advancing accessible and evidence-based rehabilitation solutions globally.

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