

Premature return to play and return to learn after a sport-related concussion

Physician's chart review

James D. Carson MD DipSportMed CCFP FCFP David W. Lawrence MD Sari A. Kraft MD Alisha Garel
Catherine L. Snow Ananda Chatterjee MD Paula Libfeld Heather M. MacKenzie MD Jane S. Thornton PhD
Rahim Moineddin PhD Pierre Frémont MD PhD

Abstract

Objective To determine what proportion of patients experience an exacerbation of their symptoms as a result of premature return to play (RTP) and return to learn (RTL) following sport-related concussions.

Design Retrospective study of electronic medical records from the office-based practice of one family and sport medicine physician who had systematically provided recommendations for cognitive and physical rest based on existing consensus recommendations. Two blinded authors independently reviewed each chart, which included Sport Concussion Assessment Tool (SCAT) and SCAT2 symptom self-report forms to determine whether an athlete had returned to play or learn prematurely. If there was a discrepancy between the 2 reviewers then a third author reviewed the charts.

Setting A sport medicine and family practice in Ontario. The physician assessed sport-related concussions after self-referral or referral from other primary care physicians, teams, and schools.

Participants A total of 170 charts of 159 patients were assessed for sport-related concussion during a 5-year period (April 2006 to March 2011). All participants were students who were participating in sports at the time of injury. There were 41 concussions in elementary students, 95 concussions in high school students, and 34 concussions in college or university students.

Main outcome measures Premature RTP and RTL were defined as chart records documenting the recurrence or worsening of symptoms that accompanied the patients' RTP or RTL. Measures were compared using the earliest available SCAT forms and self-reporting.

Results In 43.5% of concussion cases, the patient returned to sport too soon and in 44.7% of concussion cases, the patient returned to school too soon. Patients with a history of previous concussion required more days of rest before being permitted to participate in any physical activity than those patients without a previous history of concussion. Elementary school students required fewer days of rest before being permitted to return to any physical activity compared with high school students and college or university students.

Conclusion Currently, physicians recommend restrictions on mental and physical activity following sport-related concussion. This is done without clear guidelines as to what cognitive rest entails for students. Further research is required to determine how to implement a management plan for student athletes to facilitate complete recovery after concussion.

EDITOR'S KEY POINTS

- About half the students with concussions experienced symptom recurrence on returning to play or returning to learn.
- A clearer understanding of what cognitive rest entails and the optimal process of returning to school after sport-related concussions is necessary. Efforts are also needed to find the best method for constructing a physician-approved and school-coordinated plan to facilitate full recovery.
- Further research is required to determine how to best implement a management plan for postconcussion student athletes. Even when appropriate guidelines are followed and management plans are given by physicians, many patients return to school or sport too soon; more research is needed to determine how to improve adherence. The authors believe that physicians who are provided with adequate knowledge translation strategies can become better facilitators for the implementation of concussion-related medical recommendations in both sport and school environments.

This article has been peer reviewed.
Can Fam Physician 2014;60:e310-5

Retour prématuré au jeu et aux études après une commotion cérébrale dans le sport

Examen de dossiers du médecin

James D. Carson MD DipSportMed CCFP FCFP David W. Lawrence MD Sari A. Kraft MD Alisha Garel
Catherine L. Snow Ananda Chatterjee MD Paula Libfeld Heather M. MacKenzie MD Jane S. Thornton PhD
Rahim Moineddin PhD Pierre Frémont MD PhD

Résumé

Objectif Déterminer la proportion des victimes de commotion dans le sport qui présentent une exacerbation de leurs symptômes en raison d'un retour prématuré au jeu (RPJ) et aux études (RPÉ).

Type d'étude Étude rétrospective des dossiers médicaux électroniques du bureau d'un médecin de famille possédant une expertise en médecine du sport qui avait systématiquement formulé des recommandations en faveur d'un repos physique et cognitif fondées

sur les déclarations consensuelles existantes. Deux des auteurs ont indépendamment révisé en aveugle chaque dossier où on avait utilisé le Sport Concussion Assessment Tool (SCAT) et le formulaire SCAT2 d'auto-déclaration des symptômes afin d'établir si l'athlète était retourné au jeu ou aux études prématurément. En cas de désaccord entre les 2 réviseurs, un troisième auteur effectuait une révision.

POINTS DE REPÈRE DU RÉDACTEUR

- Environ la moitié des élèves et des étudiants victimes de commotion ont vu leurs symptômes réapparaître lors de leur retour au jeu ou aux études.

- Il est impérieux de mieux savoir ce qu'est le repos cognitif et la façon idéale de reprendre les études après une commotion dans le sport. Il faudra également trouver la meilleure méthode pour élaborer un plan approuvé par les médecins, en accord avec les directions d'écoles, qui soit susceptible de faciliter une guérison complète.

- D'autres études seront nécessaires pour mettre en place un meilleur plan pour s'occuper des élèves et des étudiants athlètes victimes de commotions. Même lorsque les directives appropriées ont été appliquées et qu'on a suivi le mode de prise en charge suggéré par les médecins, plusieurs des victimes retournent aux études ou au jeu trop tôt; d'autres études devront déterminer comment améliorer l'adhésion. Les auteurs sont d'avis que les médecins qui ont reçu une formation adéquate sur ce sujet sont probablement les mieux placés pour faciliter la mise en place et le suivi des recommandations, tant dans les milieux sportifs que dans les établissements d'enseignement.

Contexte Une clinique de médecine familiale et de médecine du sport de l'Ontario. Le médecin évaluait les commotions dues au sport chez ses propres patients ou chez ceux qui lui étaient dirigés par d'autres médecins de première ligne, par des équipes et par des écoles.

Participants Un total de 170 dossiers provenant de 159 patients ont été évalués pour des commotions dans le sport durant une période de 5 ans (entre avril 2006 et mars 2011). Les participants étaient tous des élèves et des étudiants qui s'adonnaient à des sports au moment de l'accident. Il y avait 41 commotions chez des élèves du primaire, 95 chez des élèves du secondaire et 34 chez des étudiants du collège ou de l'université.

Principaux paramètres à l'étude Les RPJ et RPÉ ont été établis à partir de la mention dans les dossiers d'une reprise ou d'une aggravation des symptômes à l'occasion d'un RPJ ou d'un RPÉ. Ces paramètres ont été comparés à l'aide des tout premiers formulaires SCAT ou des auto-déclarations disponibles.

Résultats Dans 43,5% des cas, les victimes de commotion ont repris le sport trop tôt et dans 44,7% des cas, elles sont retournées aux études trop tôt. Par rapport aux personnes qui n'avaient jamais eu de commotion, celles qui en avaient déjà eues nécessitaient plus de jours de repos avant d'être autorisés à reprendre une activité physique. Les élèves du primaire nécessitaient moins de jours de repos que ceux du secondaire, ou que les étudiants du collège ou de l'université, avant d'être autorisés à reprendre une activité physique.

Conclusion À l'heure actuelle, les médecins recommandent de restreindre les activités physiques et intellectuelles à la suite d'une commotion cérébrale liée au sport. Ces recommandations ne précisent toutefois pas ce que signifie un repos cognitif pour un élève ou un étudiant. D'autres études devraient préciser la façon d'établir un plan de traitement assurant un complet rétablissement des élèves et des étudiants athlètes victimes de commotion.

Cet article a fait l'objet d'une révision par des pairs.
Can Fam Physician 2014;60:e310-5

Assessment and management of sport-related concussion has evolved rapidly over the past 15 years. Until the late 1990s, sport-related concussions were assessed and managed using grading systems that relied upon key points in the injury history such as post-traumatic amnesia or loss of consciousness.¹ However, none of these grading systems used evidence-based approaches that could assist in timely and safe return to sport. Therefore, in the late 1990s physicians began to monitor injured athletes after concussion and give individualized return to play (RTP) advice.

To standardize postconcussion RTP recommendations, a committee of worldwide experts formed the Concussion in Sport Group (CISG) and held the first International Symposium on Concussion in Sport in 2001. Their recommendations were revised and updated at a second symposium in 2004, and a standardized Sport Concussion Assessment Tool (SCAT) was created.¹ These recommendations were again revised at a third symposium in 2008, which yielded the modified SCAT2.² Since the completion of our data collection, the CISG held a fourth symposium in November 2012 that yielded new tools including the SCAT3 and ChildSCAT3.³

According to the 2012 consensus statement, *concussion* is defined as “a complex pathophysiological process affecting the brain, induced by biomechanical forces.”³ The best-practice recommendation for concussion management is rest until all symptoms resolve followed by the implementation of a graded program of exertion before complete return to activity.⁴ Cognitive as well as physical rest is emphasized, particularly in the days following the injury, as activities that require concentration and attention might exacerbate symptoms and delay recovery.² In students, scholastic activities might need to be limited or adapted while symptoms persist.² However, while the 2008 consensus RTP guidance provided a very specific 6-step protocol for increasing the patient’s level of physical activity, the advice for return to learn (RTL) was problematically vague.

The CISG 2012 consensus statement advised, “In the absence of evidence-based recommendations, a sensible approach involves the gradual return to school and social activities (prior to contact sports) in a manner that does not result in a significant exacerbation of symptoms.”³ The lack of clear guidelines on cognitive rest can lead to confusion within the school environment, which can result in variable approaches and attitudes toward concussions and their management from teachers and administrative staff. A recent article suggests that even if physicians request RTL restrictions and adjustments in written form, it does not guarantee that the school can or will comply.⁵ This problem is amplified by the RTP-centred nature of postconcussion educational programs and tools, including both the SCAT2 and SCAT3.

Despite research acknowledging that adolescents and children must manage concussions more cautiously and conservatively than adults, students often have to meet educational requirements without accommodation for cognitive impairment.⁶

Kirkwood et al suggest that the development of school accommodations for concussion in students is usually premature given the rapid recovery seen in most cases.⁷ This article suggests that school accommodations are only necessary for students facing serious long-term concussion symptoms several months or years after injury.⁷ Another article argues that schools are, in fact, already very cooperative in ensuring student athletes’ safe RTL.⁸ Thus, our study seeks to illustrate that the above propositions are incorrect or insufficient; students returning to school after sport-related concussions without physician-approved and school-coordinated RTL strategies risk experiencing return of symptoms or prolonged recovery periods. Several reviews have explained the academic adjustments and accommodations that might help students to successfully RTL.^{5,9-11}

Family physicians and emergency physicians are often the first medical contact after a sport-related concussion. Given that premature physical and cognitive exertion can delay complete recovery or cause symptoms to recur, primary care physicians must provide efficacious advice to facilitate student athletes’ RTL as well as RTP. The objective of this study was to determine what proportion of patients experienced exacerbations of their symptoms (and reduction in their function) as a result of premature RTP and RTL. The goal is for physicians to be better able to assist schools in accommodating students to allow for optimal recovery.

METHODS

After the Scarborough Hospital Research Ethics Board granted ethics approval, a retrospective study was conducted of all sport-related concussion cases we assessed over a 5-year period. The principal investigator (J.D.C.) managed each of these cases, providing systematic recommendations on cognitive and physical rest based on existing consensus recommendations. These included advice to rest until symptoms resolved, and implementation of a graduated 6-step RTP strategy. The recommendations usually included a standard letter asking the school to restrict homework and examinations until symptoms resolved.

Data collection consisted of a retrospective electronic medical record chart review of patients seen in a family and sport medicine physician’s office from April 2006 until March 2011 for concussion or suspected concussion. The study population included patients with

sport-related concussions that occurred while they were students. Seventy-five charts were excluded, as the concussions were either not sport related or the patients were not concurrently students. Data collected included elements from the concussion history, results of cognitive and balance assessments at the first visit to the physician, and the SCAT or SCAT2 symptom self-report scores completed at the initial visit and at all subsequent visits. Two blinded authors (D.W.L. and either S.A.K. or H.M.M.) independently reviewed each chart and SCAT or SCAT2 symptom self-report form using a data abstraction tool (**Box 1**). In the case of a discrepancy, a third author (A.C.) reviewed the charts.

The primary outcomes, premature RTP and RTL, were defined as chart records documenting the recurrence or worsening of symptoms that accompanied patients' RTP or RTL. Descriptive statistics, means and SDs for

continuous variables, and percentages for categorical variables were calculated for chart-reviewed data.

RESULTS

During the 5-year period, 159 patients presented with 170 distinct sport-related concussions. Of the charts that met the inclusion criteria, 105 (61.8%) were for male patients and 65 (38.2%) were for female patients. Twenty-seven charts (15.9%) described an initial loss of consciousness. Overall, 55.9% of cases occurred in secondary school students, 24.1% occurred in elementary school students, and the remaining 20.0% occurred in university or college students. The patient went to an emergency department after his or her concussion in only 45 (26.5%) cases. A rule violation played a role in 45 (26.5%) concussions. **Table 1** shows the distribution of concussions by sport, and **Table 2** shows the number of cases in which the patient had a previous concussion. A relapse of symptoms occurred in 82 (48.2%) concussions. Recurrence or worsening of symptoms was noted in 43.5% of concussions following RTP, and in 44.7% of concussions following RTL.

Statistical analysis was performed to identify significant relationships among several variables (eg, loss of consciousness, emergency department visits, or sex). Only 2 such relationships were identified. Patients with a history of 1 or more previous concussions ($n=89$ concussions; 52.4%) required more days of rest before being medically authorized to return to any physical

Box 1. Information gathered and questions answered using a data abstraction tool

Information gathered and questions answered

- Age
- Sex
- School level at first visit
- Sport during which concussion occurred
- Did the concussion occur during a game, a practice, training away from the venue, etc?
- Did the patient have an initial loss of consciousness? If so, for how long?
- Did the patient experience posttraumatic amnesia? If so, for how long?
- If the patient visited the emergency department, time between injury and emergency department visit
- Time between injury and visit to sports medicine physician
- Number of visits to the doctor
- Number of previous concussions
- Were there any coaching errors that led to the injury?
- Was there a violation of rules that led to the injury?
- Was the patient allowed to return to play soon after the injury and before symptoms resolved?
- Was the patient allowed to return to play soon after the injury and before adequate medical assessment?
- Number of days until able to participate in any activity
- Time until cleared to return to play
- Did the patient have a recurrence of symptoms?
- Was the patient referred to a neurosurgeon or neurologist?
- Did the patient return to his or her sport too soon, or before he or she had fully recovered?
- Did the patient return to school too soon, or before he or she had adequately recovered?
- SCAT or SCAT2 scores at each office visit

SCAT—Sport Concussion Assessment Tool.

Table 1. Distribution of concussions by sport

SPORT DURING WHICH CONCUSSION OCCURRED	PATIENTS, N (%)
Ice hockey	104 (61.2)
Soccer	15 (8.8)
Basketball	14 (8.2)
Football	10 (5.9)
Rugby	7 (4.1)
Snowboarding	4 (2.4)
Other	16 (9.4)
Total	170 (100.0)

Table 2. Number of cases in which patients had previous concussions

NO. OF PREVIOUS CONCUSSIONS	CASES, N (%)
0	81 (47.6)
1	39 (22.9)
2	20 (11.8)
3	14 (8.2)
>3	16 (9.4)
Total	170 (100.0)

activity (on the basis of the CISG 2008 consensus statement regarding RTP²) when compared with patients (n=81 concussions; 47.7%) with no previous concussions ($P<.001$). Using the same RTP criteria, elementary school students (n=41 concussions) needed fewer days of rest (mean 11.6 days) before being permitted to participate in any physical activity compared with high school students (n=95 concussions; mean 25.1 days) and university or college students (n=34 concussions; mean 23.6 days) ($P=.0163$).

DISCUSSION

Many students with sport-related concussions experience a recurrence or worsening of symptoms after premature RTP or RTL, suggesting that they have not adequately recovered. Various factors might be responsible. Consensus recommendations (level III evidence) might be difficult to apply in a typical family medicine practice or emergency department. Recent knowledge translation strategies might not prioritize these 2 clinical settings. There is insufficient clarity about the meaning of the term *cognitive rest*, and recommendations might be ambiguous for some student athletes who are returning to school following sport-related concussions. As family physicians and emergency physicians initially assess most sport-related concussions, they play a crucial role in mitigating the duration and effects of concussions and ensuring quick and thorough recoveries. Thus, physicians can pose a barrier to recovery if they have inadequate knowledge of sport-related concussion management. Another barrier can be excessive academic expectations and inadequate knowledge of concussion management at the teacher and school administrator level.

Limitations

One limitation of our study was assuming that all recurrent symptoms resulted from not following medical recommendations. Indeed, some patients will experience recurrent symptoms even if they do follow the medical recommendations for RTP or RTL. Limitations also include those normally seen with retrospective studies. The quality of the data available to study depends on the quality of the data input into the charts. Many different elective medical students and residents entered the chart histories. Researcher bias needs to be considered, as the type of information gathered by these students was directed by the principal investigator, but not in a systematic manner. Although we developed a data abstraction tool, there was some variation in the responses of the 2 reviewers, occasionally requiring a third reviewer to determine the answer. Thus, appropriate and important information (eg, the referral

source) was sometimes not captured, resulting in possible confounding. We likely saw a greater proportion of more difficult concussion cases, resulting in referral filter bias. Only 18 of the 170 cases (10.6%) came from the principal investigator's family practice. The remainder were either self-referred or referred by the patients' family physicians, emergency department physicians, teams, or schools. Thus, our cases might not appropriately represent the population in the community owing to selection bias.

Conclusion

Our retrospective study has already helped guide prospective studies. As a result of this study, we embarked on a validated survey of Canadian primary care physicians, looking for ways to improve sport-related concussion knowledge translation (page 548).¹² We have also done a before-and-after survey in conjunction with an educators' focus group session to assess whether improvements in communication can improve concussion outcomes.¹³ Increased awareness, dialogue, and formal concussion management strategies involving students, physicians, parents, coaches, school administrators, and teachers could provide better support and a more accommodating environment that would likely yield quicker resolution of postconcussion symptoms.

About half the students with concussions experienced symptom recurrence on RTP or RTL. Currently, physicians recommend restrictions in mental and physical activity following sport-related concussion. This is done without clear guidelines as to what cognitive rest entails for students. A clearer understanding of cognitive rest and the optimal process of returning to school after sport-related concussions is necessary. Efforts are also needed to find the best method for constructing a physician-approved and school-coordinated plan to facilitate full recovery. Thus, further research is required to determine how to best implement a management plan for postconcussion student athletes. Even when appropriate guidelines are followed and management plans are given by physicians, many students return to learning or sport too soon; more research is needed to determine how to improve adherence. We believe that physicians who are provided with adequate knowledge translation strategies can become better facilitators for the implementation of concussion-related medical recommendations in both sport and school environments. 🌱

Dr Carson is Assistant Professor, **Dr Lawrence** is a family medicine resident, and **Dr Kraft** is a sport and exercise medicine fellow, all in the Department of Family and Community Medicine at the University of Toronto in Ontario. **Ms Garel** is a medical student at the Medical University of the Americas in Nevis. **Ms Snow** is a student at York University in North York, Ont. **Dr Chatterjee** is a family medicine resident at Grand Rapids Medical Education Partners and Michigan State University. **Ms Libfeld** is a graduate of the University of King's College in Halifax, NS. **Dr MacKenzie** is a physical medicine and rehabilitation resident at the University of Western Ontario in London. **Dr Thornton** is a medical student at the University of Toronto. **Dr Moineddin** is Associate Professor in the Department of Family and Community Medicine at the

University of Toronto. **Dr Frémont** is Associate Professor in the Department of Rehabilitation and Affiliated Professor in the Department of Family Medicine at Laval University in Quebec.

Contributors

All authors contributed to the concept and design of the study; data gathering, analysis, and interpretation; and preparing the manuscript for submission.

Competing interests

None declared

Correspondence

Dr James Carson, Department of Family and Community Medicine, University of Toronto, 255 Main St, Unionville, ON L3R 2H3; telephone 905 477-0027; fax 905 477-0065; e-mail james.carson@utoronto.ca

References

1. McCrory P, Johnson K, Meeuwisse W, Aubry M, Cantu R, Dvořák J, et al. Summary and agreement statement of the 2nd International Conference on Concussion in Sport, Prague 2004. *Br J Sports Med* 2005;39(4):196-204.
2. McCrory P, Meeuwisse W, Johnston K, Dvořák J, Aubry M, Molloy M, et al. Consensus statement on concussion in sport: 3rd International Conference on Concussion in Sport held in Zurich, November 2008. *Clin J Sport Med* 2009;19(3):185-200.
3. McCrory P, Meeuwisse WH, Aubry M, Cantu B, Dvořák J, Echemendia RJ, et al. Consensus statement on concussion in sport: the 4th International Conference on Concussion in Sport held in Zurich, November 2012. *Br J Sports Med* 2013;47(5):250-8.
4. Purcell L, Carson J. Sport-related concussion in pediatric athletes. *Clin Pediatr (Phila)* 2008;47(2):106-13.
5. Halstead ME, McAvoy K, Devore CD, Carl R, Lee M, Logan K, et al. Returning to learning following a concussion. *Pediatrics* 2013;132(5):948-57. Epub 2013 Oct 27.
6. McCrory P, Collie A, Anderson V, Davis G. Can we manage sport related concussion in children the same as in adults? *Br J Sports Med* 2004;38(5):516-9.
7. Kirkwood MW, Yeates KO, Taylor HG, Randolph C, McCrea M, Anderson VA. Management of pediatric mild traumatic brain injury: a neuropsychological review from injury through recovery. *Clin Neuropsychol* 2008;22(5):769-800. Epub 2007 Sep 1.
8. Hux K, Bush E, Zickefoose S, Holmberg M, Henderson A, Simanek G. Exploring the study skills and accommodations used by college student survivors of traumatic brain injury. *Brain Inj* 2010;24(1):13-26.
9. Sady MD, Vaughan CG, Gioia GA. School and the concussed youth: recommendations for concussion education and management. *Phys Med Rehabil Clin N Am* 2011;22(4):701-19. Epub 2011 Sep 25.
10. Davis GA, Purcell LK. The evaluation and management of acute concussion differs in young children. *Br J Sports Med* 2014;48(2):98-101. Epub 2013 Apr 23. DOI:10.1136/bjsports-2012-092132.
11. McGrath N. Supporting the student-athlete's return to the classroom after a sport-related concussion. *J Athl Train* 2010;45(5):492-8.
12. Stoller J, Carson J, Garell A, Libfeld P, Snow CL, Law M, et al. Do family physicians, emergency department physicians, and pediatricians give consistent sport-related concussion management advice? *Can Fam Physician* 2014;60:548-52.
13. Carson JD, Cantos M, Garell A, Libfeld PB, Meaney C, Moser SE, et al. Academic accommodation after sport-related concussion. Educators' Workshop and Focus Groups. Canadian Academy of Sport and Exercise Medicine. Sport and Exercise Medicine on the Western Edge, 2013 CASEM Annual Scientific Conference. April 24-27, 2013. Whistler, British Columbia. [Abstract] *Clin J Sport Med* 2013;23(2):e23-4.

— * * * —