Relapse of concussion symptoms in the context of premature return to learn and return to play

Comparative analysis of 2006 to 2011 and 2011 to 2016

James D. Carson MD DipSportMed CCFP(SEM) FCFP  Dion Diep MD
Carmen Baker MSc MD  Sari A. Kraft MD CCFP(SEM) DipSportMed
Nariko Kuwahara BSc  Alisha Garel MD  Pierre Frémont MD PhD CCFP(SEM) FCFP

Abstract

Objective  To determine whether the proportion of sport-related concussion (SRC) cases among student athletes that resulted in a relapse of their symptoms due to premature return to play (RTP) or premature return to learn (RTL) has changed compared with a prior (2006 to 2011) study.

Design  Retrospective cohort study of electronic medical record charts from a 5-year period (2011 to 2016) compared with previous data.

Setting  A sport and exercise medicine physician's office-based practice in Ontario.

Participants  Two-hundred forty-one students who had 258 distinct cases of SRC diagnosed.

Main outcome measures  Premature RTP and RTL were defined as chart records documenting the relapse, recurrence, or worsening of concussion symptoms that accompanied the patient's RTP or RTL.

Results  Between 2011 and 2016, premature RTP and RTL resulted in a relapse of symptoms in 26.7% and 42.6% of cases, respectively. When compared with data from the 2006 to 2011 chart review, the incidence of premature RTP decreased by 38.6%. However, the rate of the relapse of symptoms associated with premature RTL decreased by only 4.7%. There was a relapse of symptoms in 43.4% of the cases involving female students and 29.7% of the cases involving male students, indicating that female patients are more likely to experience a relapse of symptoms. Cases involving female athletes also resulted in much later RTP clearance compared with those involving male athletes, with a median duration that was almost double that of male athletes' cases (49 days vs 25 days).

Conclusion  An important decrease in the relapse of symptoms in the context of premature RTP occurred over the 2006 to 2016 period. However, this decrease was minimal for RTL. This may reflect the fact that efforts to implement structured RTP strategies arose earlier than those to implement RTL strategies. Efforts are needed to find the best method of implementing a coordinated plan for the postconcussion athlete who is returning to school.
Récidive des symptômes de commotion cérébrale dans le contexte de retours prématurés aux études et au jeu

Exclusivement sur le web

Découverte clinique

Récidive des symptômes de commotion cérébrale dans le contexte de retours prématurés aux études et au jeu


Points de repère du rédacteur

Dans un examen des dossiers d’une pratique en clinique sur une période de 5 ans (2011 à 2016), 258 cas de commotions cérébrales liées aux sports (CCS) ont été diagnostiqués chez 241 étudiants athlètes. Le retour au jeu (RAJ) prématuré et le retour aux études (RAE) prématuré ont eu pour effet la récidive des symptômes de CCS dans respectivement 26,7 % et 42,6 % des cas.

Par rapport aux résultats d’un examen semblable des dossiers, effectué dans la même pratique et portant sur les 5 années précédentes, le taux des RAJ prématurés avait connu une baisse de 38,6 % durant la période de 2011 à 2016. Toutefois, le taux de rechute n’était pas significativement différent pour le RAE prématuré durant les 2 périodes, ce qui met en évidence la nécessité de mieux faire connaître et mettre en œuvre les lignes directrices sur le RAE dans un tel contexte.

Il était plus probable que les étudiantes athlètes subissent une récidive des symptômes de CCS (43,4 % des cas) que leurs homologues masculins (29,7 %). En moyenne et de manière statistiquement significative, les athlètes féminines devaient attendre plus longtemps que leurs homologues masculins avant d’obtenir l’autorisation du RAJ; plus de recherches sont nécessaires pour comprendre pourquoi les étudiantes athlètes semblent avoir plus de difficultés à se rétablir d’une CCS et savoir ce qu’il faut faire pour y remédier.

Récidive des symptômes de commotion cérébrale dans le contexte de retours prématurés aux études et au jeu

James D. Carson MD DipSportMed CCFP(SEM) FCFP   Dion Diep MD Carmen Baker MSc MD   Sari A. Kraft MD CCFP(SEM) DipSportMed Nariko Kuwahara BSc   Alisha Garel MD   Pierre Frémont MD PhD CCMF(MSE) FCMF

Résumé

Objectif Déterminer si la proportion de commotions cérébrales liées aux sports (CCS) chez des étudiants athlètes, suivies d’une récidive des symptômes en raison d’un retour au jeu (RAJ) prématuré ou d’un retour aux études (REA) prématuré, avait changé par rapport à une étude antérieure (de 2006 à 2011).

Type d’étude Étude rétrospective de cohortes à l’aide de dossiers médicaux électroniques, portant sur une période de 5 ans (2011 à 2016) par rapport à des données antérieures.

Contexte La pratique en clinique d’un médecin spécialisé en médecine du sport et de l’exercice, en Ontario.

Participants Un total de 241 étudiants chez qui 258 cas distincts de CCS avaient été diagnostiqués.

Principaux paramètres à l’étude Les RAJ et les RAE prématurés étaient définis d’après les données des dossiers documentant la récidive, la récurrence ou l’aggravation des symptômes de commotion cérébrale à la suite du RAJ ou du RAE du patient.

Résultats Entre 2011 et 2016, le RAJ et le RAE prématurés se sont soldés par une récidive des symptômes chez 26,7 % et 42,6 % des cas, respectivement. Par rapport aux données tirées de l’examen des dossiers portant sur la période de 2006 à 2011, l’incidence du RAJ prématuré avait chuté de 38,6 %. Toutefois, le taux des récidives des symptômes associés au RAE prématuré n’avait baissé que de 4,7 %. Il s’est produit une récidive des symptômes dans 43,4 % des cas chez les étudiantes et dans 29,7 % des cas chez les étudiants, ce qui indique que les patientes sont plus susceptibles de connaître une récurrence des symptômes. Chez les athlètes féminines, le temps d’attente pour obtenir l’autorisation du RAJ était beaucoup plus long que chez les athlètes masculins, soit une durée moyenne de presque le double de celle des athlètes masculins (49 c. 25 jours).

Conclusion Il s’est produit une baisse importante des récidives des symptômes dans le contexte d’un RAJ prématuré par rapport à la période de 2006 à 2011. Cependant, cette diminution était minimale pour le RAE. Cela pourrait être attribuable au fait que les efforts pour implanter des stratégies structurées de RAJ ont été déployés avant les initiatives de mise en œuvre des stratégies de RAE. D’autres efforts sont nécessaires pour trouver la meilleure façon de mettre en œuvre un plan coordonné pour les athlètes qui retournent aux études à la suite d’une commotion cérébrale.
Relapse of concussion symptoms in the context of premature return to learn and return to play

Over the past 2 decades, considerable attention has been paid to sport-related concussion (SRC) and its impact on youth. The Concussion in Sport Group's 2016 international consensus statement defines SRC as a traumatic brain injury induced by biomechanical forces resulting in a functional brain disturbance. Its signs and symptoms manifest within at least 1 clinical domain: somatic symptoms, cognitive symptoms or cognitive impairment, emotional symptoms, balance impairment, behavioural changes, or sleep cycle disturbance. Scientists and policy makers have identified the importance of addressing SRC, and guidelines have been implemented across Canada and internationally to allow athletes to return to play (RTP) safely. Although it is well understood that concussions can affect many aspects of cognition, far less has been done to help athletes safely return to school. For instance, in some areas, the implementation of strategies for academic accommodation following a concussion may still be limited.

Primary care physicians have historically had difficulty with consistently assessing and managing SRC for RTP and return to learn (RTL). A previous chart review found that between 2006 and 2011, 43.5% of SRC cases resulted in returning to sport too soon and 44.7% of SRC cases resulted in returning to school too soon. Although advocates have called for the use of a graduated 6-step RTP strategy for more than a decade, it was not until 2016 that the Concussion in Sport Group included a graduated RTL in both the adult Sport Concussion Assessment Tool, 5th edition, and the Child Sport Concussion Assessment Tool, 5th edition. With the rapid evolution of SRC management and increased public awareness in recent years, the purpose of this study was to determine whether the proportion of student athletes who experienced an exacerbation of their symptoms due to premature RTP or RTL following an SRC has changed compared with the prior (2006 to 2011) study.

Methods

A retrospective electronic medical record chart review in a sport and exercise medicine physician’s (J.D.C.) office in Unionville, Ont, was conducted between 2011 and 2016. Ethical approval was obtained from the Scarborough Hospital Research Ethics Board. The methodology was identical to that for the previous chart review. The inclusion criteria were SRCs in patients who were also students and who were participating in sports when they were injured. Exclusion criteria included more severe brain injury, including focal neurologic signs or seizure related to injury. All patients received appropriate medical counseling about RTP and RTL in our office. They were managed using systematic recommendations for cognitive and physical rest based on the consensus guidelines at the time, including a 6-step RTP strategy consisting of a gradual transition between no activity, light aerobic exercise, sport-specific exercise, non-contact training drills, full-contact practice, and RTP; the strategy also included standardized documentation to schools requesting restrictions on homework, examinations, and assignments until symptoms resolved.

Data collected included medical attention received prior to presenting at our office (eg, emergency department or other primary care provider), Sport Concussion Assessment Tool, 3rd edition, symptom self-report scores at all visits; level of education at the time of concussion; and participant demographic characteristics including sport of participation and sex. Two blinded research team members independently reviewed each chart and symptom self-report form (Sport Concussion Assessment Tool, 3rd edition) using a data abstraction tool. A third research team member resolved disagreements. Data were analyzed using means and SDs for continuous variables and percentages for categorical chart-reviewed data. Wilcoxon 2-sample tests, Kruskal-Wallis tests, and Spearman correlation tests were used where appropriate.

Primary outcome measures included differences between the results of the 2006 to 2011 and 2011 to 2016 chart reviews for premature RTP and RTL. Premature RTP and RTL were defined as recurrence or worsening of symptoms that accompanied a patient’s attempt to fully RTP or RTL, based on chart documentation. Premature RTP included cases of patients who were not medically cleared for full RTP and who subsequently reported worsening or recurrence of symptoms. Premature RTL included students for whom the academic accommodations provided by the school were either inadequate or inappropriate for the academic expectation level. This resulted in the student categorized as premature RTL becoming cognitively overwhelmed, resulting in more symptoms. Secondary outcome measures included time to RTP clearance (defined as being asymptomatic following completion of step 5 of the graduated 6-step RTP), the number of previous concussions, and the relationship of these measures to the student’s school level.

Results

Electronic medical record charts for 403 patients were reviewed for 2011 to 2016, and 241 patients with 258 distinct cases of SRC met the inclusion criteria. The data for sex, educational level, and sport involvement are presented in Table 1. A relapse of symptoms was found in 92 SRC cases due to premature RTP or RTL. Premature RTP was reported in 26.7% of SRC cases and premature RTL in 42.6% of SRC cases. When compared with the 2006 to 2011 chart review, the percentage of cases with premature RTP decreased by 38.6% (95% CI -52.8% to -19.9%; P=.0003; Table 2). However, a statistically non-significant decrease of only 4.7% in the percentage of cases involving premature RTL was observed.
There was a significant difference between the sexes in the proportions of SRC cases with a relapse of symptoms, with relapse occurring in 43.4% of the cases involving female athletes and 29.7% of the cases involving male athletes ($P=0.023$). Cases involving female athletes were also found to have significantly longer ($P<0.001$) delays (mean [SD]) in being cleared for RTP (74.5 [76.5] days) compared with those affecting male athletes (42.3 [58.8] days) and the median time to RTP clearance was nearly double (49 days vs 25 days, respectively).

The number of previous concussions was significantly associated with a relapse of symptoms in the context of premature RTP ($\chi^2=9.23, P<0.05$). No relationship was identified between the number of previous concussions and premature RTL ($\chi^2=1.88, P=0.60$). Cases involving female athletes were found to result in a premature RTL more often than those involving male athletes (54.0% vs 33.8%, respectively; $\chi^2=10.58, P<0.001$). Additionally, premature RTL was significantly more likely among secondary school students (n=62, 48.8%) compared with elementary (n=14, 28.0%) or postsecondary students (n=34, 42.0%; $\chi^2=6.38, P<0.05$).

**Table 1. Distribution of concussion cases from 2011 to 2016 by sex, education level, and sport: N=258.**

<table>
<thead>
<tr>
<th>CHARACTERISTIC</th>
<th>N (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td></td>
</tr>
<tr>
<td>• Female</td>
<td>113 (43.8)</td>
</tr>
<tr>
<td>• Male</td>
<td>145 (56.2)</td>
</tr>
<tr>
<td>Level of education</td>
<td></td>
</tr>
<tr>
<td>• Elementary school</td>
<td>50 (19.4)</td>
</tr>
<tr>
<td>• Secondary school</td>
<td>127 (49.2)</td>
</tr>
<tr>
<td>• College and university</td>
<td>81 (31.4)</td>
</tr>
<tr>
<td>Sport</td>
<td></td>
</tr>
<tr>
<td>• Ice hockey</td>
<td>119 (46.1)</td>
</tr>
<tr>
<td>• Rugby</td>
<td>39 (15.1)</td>
</tr>
<tr>
<td>• Soccer</td>
<td>23 (8.9)</td>
</tr>
<tr>
<td>• Other sports</td>
<td>77 (29.8)</td>
</tr>
</tbody>
</table>

**Table 2. Comparison of rates of premature RTP and RTL for chart reviews completed during 2006 to 2011 and 2011 to 2016**

<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>PREMATURE RTP, %</th>
<th>PREMATURE RTL, %</th>
<th>PREMATURE RTL AND RTP, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. 2011 to 2016 chart review</td>
<td>26.7</td>
<td>42.6</td>
<td>35.7</td>
</tr>
<tr>
<td>B. 2006 to 2011 chart review*</td>
<td>43.5</td>
<td>44.7</td>
<td>48.2</td>
</tr>
<tr>
<td>Absolute change (A-B), %</td>
<td>-16.8</td>
<td>-2.1</td>
<td>-12.5</td>
</tr>
<tr>
<td>Relative change ([A-B]/B), %</td>
<td>-38.6*</td>
<td>-4.7</td>
<td>-25.9</td>
</tr>
</tbody>
</table>

*RTP—return to play, RTL—return to learn, *Data from the 2006 to 2011 chart review reproduced with the permission of Canadian Family Physician.*

**Discussion**

This study assessed the proportion of symptom recurrences with RTP and RTL following SRC, likely associated with nonadherence with the RTL and RTP recommendations. We interpret nonadherence broadly as a multifactorial concept that includes both the patient’s contribution and all external factors that can result in difficulties in obtaining adherence (ie, proper implementation of the recommendations) in the patient’s environment, particularly in school. It is possible that RTL recommendations may be more challenging to implement than RTP recommendations, as they involve a more complex environment characterized by multiple stakeholders (eg, several teachers for any given student).

We compared our findings with previous data from 2006 to 2011. There was a large decrease in the rate of premature RTP but a minimal decrease in the rate of premature RTL over the subsequent 5 years. Since the previous chart review, there has been a large push for more education about and better management of SRC with widespread dissemination of protocols and policies targeting sport with a focus on the RTP strategy. This may have contributed to the large decrease in the rate of premature RTP.

In contrast, there was an absence of any widely adopted RTL consensus or guideline and a lack of patient, parent, and physician understanding of appropriate concussion management in this context. This likely resulted in better buy-in from stakeholders for RTP compared with RTL.

Until the Concussion in Sport Group’s 2016 conference, there was a lack of consensus and capacity regarding safely returning athletes to the classroom. In Canada, the first policy requiring the implementation of a formal RTL strategy following a concussion became effective in the province of Ontario in January 2015. Since then, there has been more recent creation of policies regarding the implementation of standardized practices for safe RTL. The impact of this is profound given the potential for long-term sequelae of persistent symptoms to negatively affect students’ overall success at school. Furthermore, it is not yet clear why it appears that female students struggle more with recovery from concussion. We should prioritize exploring these aspects more in future research.

Our goal as primary care physicians should be to educate athletes on how to adjust their cognitive load, gradually transitioning back to full academic responsibilities in the classroom. Additionally, we should be providing better documentation to educators and administrators to better support our student athletes in successful RTL. We hope future efforts to support the implementation of RTL strategies will help address this problem. An example of such an initiative is SCHOOLFirst, a new Internet-based resource intended for use by educators across...
The dissemination and implementation of SCHOOLfirst can be facilitated by family physicians, as we serve as a resource for our communities. Additionally, Canadian physicians can access excellent concussion management resources from the Concussion Awareness Training Tool and Parachute Canada websites.

Limitations
This study was limited by its retrospective, chart review design. Data quality was dependent on the content inputted into the charts. These data were obtained from a single practice, which can be seen as a limitation as it may not reflect end results obtained by other physicians. Yet this can also be interpreted as a strength of the study since the initial counseling can be presumed to have been consistent from patient to patient. This supports the idea that the change observed is not the result of a change on the medical side of the equation, but a change on the implementation side in school and sport settings. We likely saw a greater proportion of more difficult concussion cases, resulting in referral bias. Additionally, it was difficult to assess whether all patients followed medical advice consistently. Regardless of management capacity, some patients will have more difficult cases that result in symptom exacerbation.

Conclusion
An important decrease in the relapse of symptoms in the context of premature RTP occurred over the 2006 to 2016 period. However, this decrease was minimal for RTL. This may be related to efforts to implement structured RTL strategies being initiated earlier than more recent efforts to implement RTL strategies. In addition, longer recovery from SRC appears to be more common among female students. More emphasis should be placed on user-group education and additional research for better management of RTL after an SRC. Efforts are needed to find the best method of implementing a coordinated plan for the athlete who is returning to school after a concussion.

Acknowledgment
We thank Dr Babak Aliazadeh for his support in conducting this study.

Contributors
Drs Dion Diep and Carmen Baker contributed to the analysis and interpretation of data and to the preparation of the manuscript for submission. Dr Pierre Frémontr contributed to the concept and design of the study; data analysis and interpretation; and the preparation of the manuscript for submission. All other authors contributed to the concept and design of the study; data gathering, all analysis; and preparing the manuscript for submission.

Competing interests
None declared

Correspondence
Dr James D. Carson— e-mail: james.carson@utoronto.ca

References

This article has been peer reviewed.
Cet article a fait l’objet d’une révision par des pairs.