

The neuroprotection project: a community-based initiative towards fostering safer playing fields, and reducing sport-related concussions

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Re: Sports-related concussions in Canada

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1. Introduction

Policy makers have an important role to play to ensure that youth and amateur contact sports remain safe for athletes. In recent years, the increasing rates of sport-related concussions (SRC) have raised concerns within the sport community, causing governing bodies to question whether or not kids should be allowed to participate in contact sports, such as football. This is in concordance with worries that repetitive exposure to sub-concussive impacts may contribute to changes in the brain, which in turn, may lead to more serious complications in later stages of life. While it is true that participation in sports like football, hockey and rugby may involve greater risks for injuries (including SRC), it is premature and impractical to argue that collisions sports should not be offered to youth and high-school athletes. Instead, governing bodies should focus their resources towards initiatives in place to identify and mitigate the risks for injuries, as a way to enhance coaching practices and promote safer playing fields, while preserving the social, psychological and health-related benefits associated with sports.

Recently, the legislative assembly of Ontario enacted the Rowan's law (bill 193), becoming the first Canadian governing party to take leadership towards reducing concussions in athletes. In response to the enactment of Rowan's law, this article will build upon the current literature on sport injury prevention, in order to provide recommendations intended to make youth, amateur and competitive football safer. It will be argued that these actions are complementary to the objectives that define Rowan's law, which together, will work to promote safer playing fields through evidence-based coaching practices. The purpose of this discussion is to invite decision-making parties to recognize the current limitations in identifying risks for head injuries, in order to inspire the investment of resources towards the development of pro-active injury-prevention methods that will effectively reduce the occurrence and consequences of sport-concussions, while enhancing sport performance.

2. Introducing a pro-active injury prevention initiative aimed at reducing the risks for head injuries

2.1. What are the risks and can we modify them?

In an effort to minimize the cumulative risks of repetitive head impacts, and improve player safety, the Canadian Football League (CFL) recently eliminated all full-contact practices during the regular season.¹

Although this was a great display of leadership from the governing officials, it is less likely that the implementation of such initiative in youth, high-school and even collegiate football would be as effective at reducing the risks for injury. This is primarily because the “risk” is a function of both the environment, and the player himself. Thus, although this policy may work to reduce the environmental risks (i.e. less opportunities for players to get hit or to hit somebody), it does not address the risks associated with the player’s behavior (i.e. playing style and technique). In all three sub-levels of competition (youth, high-school and collegiate), football practices are a major source of concussion, likely due to the greater number of sessions, compared to games.² As oppose to removing contact from practices entirely, we must re-consider the frequency upon which we expose our players to collisions drills, while modifying the ways we coach athletes on the field, without taking away the instructive components of training sessions. Simple alternative coaching practices like the use of bags and tackling/blocking dummies to conduct contact drills will reduce the total count of head-to-head collisions, and subsequently, the risks for injuries. This is even more relevant in youth and high-school levels, during which it is critical that we properly instruct developing players how to *safely* receive or deliver hits on the football field.

In studies of youth level hockey, it has been shown that playing pee-wee (aged 11-12 years) in leagues with no contact (Québec) reduces the risks of injury.³ However, a follow-up study⁴ showed that bantam hockey players (aged 13-14 years) who had had exposure to contact in pee-wee (Alberta) showed a lower risk for head injuries, as oppose to players who were first introduced to contact in bantam. Moreover, the risks for injury in Alberta pee-wee players was the same as the risks for injury in Québec bantam players, suggesting that the risk of injury is a product of inexperience with contact, and not the age of introduction. This raises an important question regarding the appropriate age to introduce contact in youth sports. Should we wait until athletes get to bantam (older) in order to allow for the brain to mature, prior to exposing it to possible injuries? Or should we introduce it while the kids are in pee-wee (younger) under the argument that the older players are bigger, faster and stronger, which may also increase the repercussion and severity of the injuries? Along those lines, is there an age at which kids learn better and are more coachable regarding changing their playing habits? In other words, is intervening earlier allowing coaches to install proper biomechanics that will be carried on? The answers to these questions will be critical as we move on with improve safety in sports.

Although differences in legislation for contact have not been studied in football, some have proposed that athletes should only be allowed to play non-contact flag football, until the age of 14. It is respectfully argued in this article that this solution presents with some limitations that require careful considerations, moving forward. First, as seen with hockey, the introduction of contact increases the risks for head injury, independently of the age group. Thus, if football players only learn the proper biomechanics of hitting at 14 years old, there may be an elevated risk associated with the distinct differences in pubertal timing that are seen in males,⁵ which increase the variability in body size (body mass, height, weight) and strength, across players. Though this is also possible for younger ages, the non-linear relationship between age and growth suggests that there may be greater disparities across observed pubertal developments around 13-14 years of age. Because most head injuries in football results from players colliding against one another,⁶ it is imperative that athletes are taught the proper ways to deliver, and receive contact, in order to mitigate the risks. This is even more significant knowing now that the strain forces transferred to brain tissues are heavily dependent on the location of impacts, as well as the kinematic differences between struck versus striking football players.⁷

Unlike contact and non-contact hockey, flag football and American football have fundamental differences in the way each game is played. For instance, flag is heavily biased towards smaller and faster players, as the foundation of the game is based on distributing the ball to the boundaries. Contrary to American football, where each kid can be assigned a position that will favor his size and skillset, flag has larger barriers of entry, which will prevent bigger/slower kids to even participate until they get to the age of 14. This may induce subsequent health-related and social development issues associated with not participating in youth community sports, such as isolation, poor physical fitness, and lack of confidence.⁸ Alternative solutions such as the removal of special teams plays (where there is the greatest risk for head injuries), smaller field sizes (limiting the speed and closing distance between colliding bodies), lower number of players on the field (limiting the total numbers of impacts and risks for collisions) and most importantly, better teaching of fundamental technique using evidence-based coaching practices (covered in the next section) may be more effective in reducing head injuries in youth football, as opposed to just forcing players to play flag, and shift the risks onto another age group.

2.2. Mitigating the risks using evidence-based sport-injury prevention

Football fosters an environment through which players learn to battle adversity, develop a work ethic, be disciplined, embrace teamwork, and most importantly, appreciate each other's differences knowing that diversity is their strength. It is because of these factors that we must invest in making the sport safer, and that resources and initiatives designed for this purpose must be made accessible across all levels of play.

The preventive measures currently incorporated into the legislative framework⁹ are highly focused around educating sport stakeholders, in order to enhance the way we recognize and manage SRC. Though partly effective in raising awareness about concussions, it has become clear that education provides only part of the solution, as it does not reduce the risk of injuries associated with the player's behavior on the field. **Thus, in an effort to address this gap, it is argued here that collision sports like football should introduce pre-season functional movement baselines, as a way to pro-actively determine athlete-specific risks for head injuries. Then, such information can be used towards the introduction of preventive coaching practices designed to enhance sport performance, through injury prevention. By effectively identifying, recognizing, and modifying the factors that create the risks, we promote a playing environment that is safer through which players can stay off the injury list, contribute positively to the success of their team, and maintain longer and healthier careers.**

As shown in **Figure 1A**, what is proposed is the design of sport-specific test batteries that have for objective to assess, identify, and actively modify the player's risks for musculoskeletal and head injuries. These risks may result from poor technique during tackling (no breakdown, leaning with the head, out of control, wrongful head placement, etc.) or blocking (no breakdown, no use of hands, leaning with head first, out of control, etc.) which is the product of both the player's skillset, and the strategies used to implement these techniques by the coaching staff. In identifying these weaknesses at baseline, pre-season, this approach offers a unique opportunity to modify the behaviors that are responsible for putting players out of position, and often, create the injuries. Sport-specific assessments are to be designed based on the primary mechanisms of injury that most often cause SRC in the sport of interest. This is in an effort to keep the testing battery specific, time efficient and in accordance with the risk-analyses provided in the literature.

In football, player-to-player collisions (i.e. tackling and blocking) are the most common causes of injury.⁶ As a way to provide an exemplar for our recommendations, our team designed four key drills that have recently been introduced to local youth, high-school and collegiate football teams (N > 1200 players aged between 9-19 years). Each drill is intended to assess skills that incorporate football performance (i.e. cutting, rapid change in direction, agility, acceleration/deceleration) and sport safety (i.e. breaking down, head placement), in order to examine the athlete's ability to execute game-like assignments in a non-padded controlled environment. Using a standardized scoring system designed specifically for each drill, the footage from baseline is then scored to gather information about each player, and further determine whom may be at greater risks for injury and why. Once identified, this information is used to design evidence-based training protocols to be implemented into the day-to-day practice routine, in order to address specific issues that are relevant to the players' needs. This intervention is personalized all the way down to the player's level, which is a critical component in providing ways to reduce the risks arising and associated with poor technique. Most importantly however, this intervention is designed to integrate both sport performance and sport safety as one comprehensive model. This, in our opinion, is a fundamental component that will allow coaches to mitigate risks of injuries on the field, while maintaining the core features that make up the game of football.

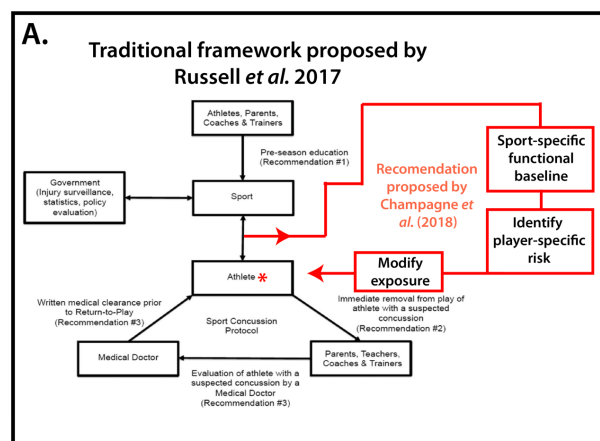


Figure 1. Proposed recommendation to be added to the traditional legislative framework. **(A)** Conceptual framework proposed in Russell *et al.* (2017) advising governing bodies about the proper considerations to implement in the making and eventual enacting of Rowan's law in Ontario. In red are the recommendations described in this article regarding the introduction of sport-specific functional baseline tests designed to objectively intervene at the athlete's level and modify the exposure to injury.

2.3. Using school curriculum to enhance coaching and change the culture around sport safety

One key expectations of the *Healthy Active Living Education* curriculum released by the Ontario government for grades 9 to 12 (page 97)¹⁰ is that students will:

- 1) “(B1) perform movement skills, demonstrating an understanding of the basic requirements of the skills and applying movement concepts as appropriate, as they engage in a variety of physical activities”, and
- 2) “(B2) apply movement strategies appropriately, demonstrating an understanding of the components of a variety of physical activities, in order to enhance their ability to participate successfully in those activities.”

As a sport community moving forward, it is in our best interest to implement initiatives like the ones proposed above into the educational system, as a way to catalyze a change in the culture. If students are taught and engaged about methods to enhance the way we play sports, while creating safer fields, it is expected that the attitudes, expectations and perspectives towards making football safer will arise naturally from that process.

3. Summary of recommended framework to reduce sport-related concussions in youth and high-school sports

The recent enactment of the Rowan’s law provides a platform through which governing bodies, medical officials and community sport stakeholders can combine efforts towards reducing the occurrence and consequences of SRC in youth and high-school football. To date, this is the first Canadian concussion legislation put in place, which is a testament to Ontario’s leadership in promoting safety in youth sports and optimizing education, prevention and management of SRC. In this article, we proposed to complement the current conceptual framework in place for Rowan’s law using sport-specific functional baseline assessments, in the effort to pro-actively identify, and effectively modify the risks for injuries in developing athletes. Moreover, we addressed the need to integrate such initiatives within the school board’s curriculum, as a way to make sport safety and performance a priority, and a resulting product from the dynamic change in culture that such initiative

will facilitate. In the end, we hope that these steps will help inspiring the idea that football, and other collision sports, can be made safer for our athletes, and that, without the need to change the integrity of the game.

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Supplementary material regarding our initiative to make sports safer:

Live morning show at Global news:

<https://globalnews.ca/video/4516157/queens-university-works-with-the-limestone-district-school-board-in-creating-new-concussion-protocols>

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Newest article in the local Whig:

<https://www.thewhig.com/news/local-news/kingston-high-school-football-players-studied-to-improve-safety>

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Invited guest speaker on concussion talk podcast: episode 30

<https://soundcloud.com/concussion-talk-podcast/episode-30-allen-champagne-phd-sports-related-concussion>

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Project video – Queen’s University:

https://www.youtube.com/watch?v=v88w_B7n8nc

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Radio-Canada Radio:

<https://ici.radio-canada.ca/premiere/emissions/sur-le-vif/segments/entrevue/74984/commotion-cerebrale-accident-sport-adolescents>

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CBC

<https://www.facebook.com/allen.champagne/videos/1829422797102323/UzpfSTEwMDAwMTAzODYyMjA3NTozMDYwNjExMjk0OTk0MTQ6MTA6MDoxNTI1MTU3OTk5Oi04MTYxMzIwMTk5OTc2MDU3NzE4/>

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CTV

https://montreal.ctvnews.ca/lachine-football-players-put-experimental-research-technology-to-use-1.3885508#_gus&_gucid=&_gup=Facebook&_gsc=uXe6YhP

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Radio-canada (French)

<https://ici.radio-canada.ca/sports/1095230/commotion-cerebrale-dalbe-viau-recherche-mouvement-entrainement-football>

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Global news (summer projects):

<https://globalnews.ca/news/4160552/queens-university-phd-student-allen-champagne-wants-to-put-an-end-to-sports-injuries/>

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The Gazette

<http://montrealgazette.com/news/local-news/football-players-turned-scientists-aim-to-reduce-concussion-risk>

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Grenadiers press release

<http://grensfootball.website.siplay.com/News/Id/36600>

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OPFL

https://www.opfootball.ca/news_article/show/898464

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Whig:

<http://www.thewhig.com/2018/04/20/study-aims-to-make-football-safer>