

Blunted Cardiac Parasympathetic Activation in Student Athletes With a Remote History of Concussion: A Pilot Study

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Abstract

Introduction: Blunted cardiac autonomic nervous system (ANS) responses, quantified using heart rate variability (HRV), have been reported after sport-related concussion (SRC). Research suggests this persists beyond clinical recovery. This study compared cardiac parasympathetic responses in student athletes with a remote history of SRC (> 1-year ago, Concussion History: CH) with those who reported no lifetime history of SRC (Concussion Naïve: CN). **Design:** Retrospective nested case-control. **Setting:** University laboratory. **Patients or Other Participants:** CH ($n = 9$, 18.3 ± 2 years, 44% male, median 2 years since injury) were student athletes with a remote history of concussion(s) from more than 1 year ago. CN ($n = 21$, 16.7 ± 3 years, 67% male) were student athletes with no lifetime history of concussion. Exclusion criteria included taking medications that could affect ANS function, history of concussion within the past year, persistent concussion symptoms, lifetime history of moderate to severe brain injury, and lifetime history of more than 3 concussions. **Material and Methods:** Participants performed the Face Cooling (FC) test for 3-min after 10-min of supine rest while wearing a 3-lead electrocardiogram in a controlled environment. **Outcome Measures:** Heart rate (HR), R-R interval (RRI), root mean square of the successive differences (RMSSD) of RRI, high frequency (HF) and low frequency to HF (LF:HF) ratios. **Results:** At baseline, CH had a lower resting HR than CN (62.3 ± 11 bpm vs. 72.9 ± 12 , $p = 0.034$). CH had a different HR response to FC than CN (+8.9% change from baseline in CH vs. -7.5% in CN, $p = 0.010$). CH also had a smaller RMSSD increase to FC than CN (+31.8% change from baseline in CH vs. +121.8% in CN, $p = 0.048$). There were no significant group differences over time in RRI ($p = 0.106$), HF ($p = 0.550$) or LF:HF ratio ($p = 0.053$). **Conclusion:** Asymptomatic student athletes with a remote history of concussion had a blunted cardiac parasympathetic response to FC when compared with athletes with no lifetime history of concussion. These data suggest that an impaired autonomic response to a physiological stressor persists after clinical recovery from SRC for longer than previously reported.

Keywords: autonomic nervous system; concussion; face cooling; heart rate variability; sport.