TACSM Abstract

Improvement in Heart Rate Variability during Mild Cognitive Task Following Concussion

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ABSTRACT

Cognitive rest is widely recommended following concussion until symptoms resolve. Unlike return-to-play protocols, there is a lack of clear guideline for return-to-learn in student athletes. Heart rate variability (HRV) is an index of cardiac health and reduced HRV is associated with disturbances in the autonomic nervous system (ANS) following concussion. Therefore, the purpose of our study was to examine ANS modulation utilizing HRV at rest and during mild cognitive task in concussed and non-injured control athletes.

Nineteen collegiate athletes (20 ± 1 years) with a physician-diagnosed sports-related concussion were enrolled in the study acutely (4 ± 1 days) following a concussion. Nineteen sports matched non-injured controls also participated. Continuous heart rate recording was obtained with a standard three-lead electrocardiogram at rest and during a mild cognitive task while subjects where seated upright. Resting data was collected for 6 minutes. A computer based cognitive test (2-Back) designed to assess sustained attention and executive function was administered for 3 minutes. Average response time and the percentage of correct responses were obtained from the 2-Back trial. HRV was analyzed with power spectral analysis within the low (LF, 0.04-0.15 Hz) and high (HF, 0.15-0.4 Hz) frequency domains. Normalized LF and HF power spectral densities (n.u.) and LF/HF ratio were obtained. Two-way repeated measures ANOVA {group (concussed, control) x condition (rest, 2-Back)} was used to examine the variables.

Higher LF (61.1±15 vs. 45±12, P=0.007), lower HF (38.8±15 vs.54.4±12, P=0.008) variability and higher LF/HF ratio (2.2±2 vs. 0.92±0.4, P= 0.005) were observed in the concussed athletes compared to controls at rest indicating exaggeration of the sympathetic nervous system modulation. Conversely, lower LF (44.5±14, P=0.003), higher HF (55.4±14, P= 0.003) and lower LF/HF ratio (0.92±0.5, P=0.003) was observed with 2-Back cognitive tasks as opposed to rest in the concussed group. The control group showed no difference in HRV between rest and 2-back trials. Despite similar response times for the 2-Back cognitive task, the percentage of correct response was lower (79.9±14.2 vs. 89.9±4.6, P=0.008) in the concussed athletes compared to the non-injured athletes.

Disturbances in ANS exist as early as 4 days following a concussion. Mild cognitive tasks during rehabilitation may be advantageous in improving cognitive function on and off the field and may expedite the return-to-learn phase in student athletes. Further studies in this field are needed to determine if

current complete cognitive rest is possibly inhibitory to recovering in concussed athletes, as opposed to mild cognitive task to promote ANS function.