TACSM Abstract

Impairment of Physiological Complexity of Postural Control Persists Beyond Resolution of Postural Sway Following Concussion

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ABSTRACT

In healthy individuals, physiological functions are regulated by complex integration of multiple control systems, feedback loops, and regulatory processes that enable an individual to adapt to everyday life. The control systems exist at cellular, organ, and systemic levels, operating at various time scales. Entropy analysis can be utilized to assess complexity of physiological systems, including postural control. Higher complexity is associated with better physiological functioning and loss of complexity is associated with pathologies. Increased postural sway is reported following concussion. **PURPOSE**: Therefore the purpose of this study was to examine postural control dynamics utilizing postural sway and complexity across three time points (days 3, 21, and 90) following concussion and compare them with matched control athletes. **METHODS**: Data was collected longitudinally on 25 collegiate athletes at days 3, 21, and 90 following concussion and cross-sectionally for 25 matched controls. Postural sway was measured on a force plate during quiet standing for 60-second trials with eyes opened (EO) and eyes closed (EC). Postural sway was estimated from the deviations from the center of pressure (COP) in the anteroposterior direction. Multiscale entropy analysis was used to determine the postural complexity index, defined as the sum of the entropies computed for different time resolution scales of the COP signal. Independent t-tests were used to compare the data between the concussed and control athletes. **RESULTS**: Concussed athletes exhibited greater sway (EO: 27.2±9.1mm vs. 22.0±5.3mm P=0.0190; EC: 30.7±10.7mm vs. 22.4±5.1mm P=0.0014) and reduced complexity (EO: 2.8±0.9U vs. 3.8±0.9U P=0.0008; EC: 3.1±0.9U vs. 4.0±0.8U P=0.0009) 3 days following concussion compared to the controls. Sway remained high during the EC trial (27.7±9.6mm P=0.0255) and reduced complexity persisted in both the EC and EO trials (EO: 3.2±1.0U P=0.0468; EC: 3.4±0.9U P=0.0256) 21 days post-injury. Despite no difference in sway between concussed and control athletes, complexity remained blunted 90 days following concussion (EC: 3.5±0.8U P=0.0497). **CONCLUSION**: Postural complexity may be a more sensitive biomarker for tracking physiological recovery and it might play an important role in return-to-play decision making as well as prevention of concussion related secondary injuries.

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