

Microsaccades: The relationship with vestibular dysfunction and prolonged symptoms after concussion

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Background and Aims: Comprehensive testing used alongside history and physical to evaluate patients after traumatic brain injury include Oculomotor, balance, cognitive, and exertional testing. Oculomotor Tracking (OMT) devices can be used to objectively quantify oculomotor deficits. Microsaccades (MS) are adjustive eye movements happening during visual fixation, which may become excessive or intrusive after mTBI. Data on microsaccades in post-concussion patients is limited. We hope to investigate the role of microsaccades in vestibulocular dysfunction and prolonged post concussive symptoms (PPCS).

Methods: A retrospective cross-sectional pilot chart review of 120 randomly selected patients ages 8-76 diagnosed with concussion was performed. We evaluated the microsaccade number from the OMT device, and mean sway velocity using force plate testing during the two-foot eyes closed position. We defined balance testing failure as mean sway velocity greater than or equal to 0.5 degrees/second based on normative data. A two-sample t-test was performed to investigate the relationship of microsaccades and balance testing. We also investigated those with excessive microsaccades rate, defined as >1.43 MS/second, or MS magnitude >1.5 degrees.

Results: Mean MS rate and magnitude were 0.95 MS/second and 1.21 degrees, respectively. There was a positive correlation with longer recovery times. A total of 58 patients passed balance testing; 61 patients failed. Patients who passed had a mean microsaccade rate of $0.92/\text{second} \pm 0.3$, MS magnitude of 1.166 degrees. Patients who failed had a mean microsaccade rate of $0.98/\text{second} \pm 0.44$. ($p=.377$), MS magnitude of 1.256 degrees. Of the 16 patients with excessive MS rate, 95% had PPCS (>1 month), 63% had symptoms for >3 months, and 69% failed force plate testing. Of the 17 patients with excessive MS magnitude, 90% had PPCS, 53% had symptoms for >3 months, and 65% failed force plate testing.

Conclusion: Subjects with an increased number of microsaccades showed a trend related to more vestibular sway and test failure; but did not demonstrate statistical significance at this n value. There is also a striking trend of prolonged recovery times in patients with excessive

microsaccade rate (>1.43 MS/second) and magnitude (>1.5 degrees.) We intend to further investigate with a larger sample size to evaluate pilot trends.