Quantifiable measures of eye-tracking and their correlation with the VOMS score in concussed subjects

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Introduction: Concussion prevalence has become a concerning issue, compounded by limitations in current assessment tools that rely on subjective, qualitative data with only moderate test-retest reliability [1,2]. The need for a quantitative tool is apparent.
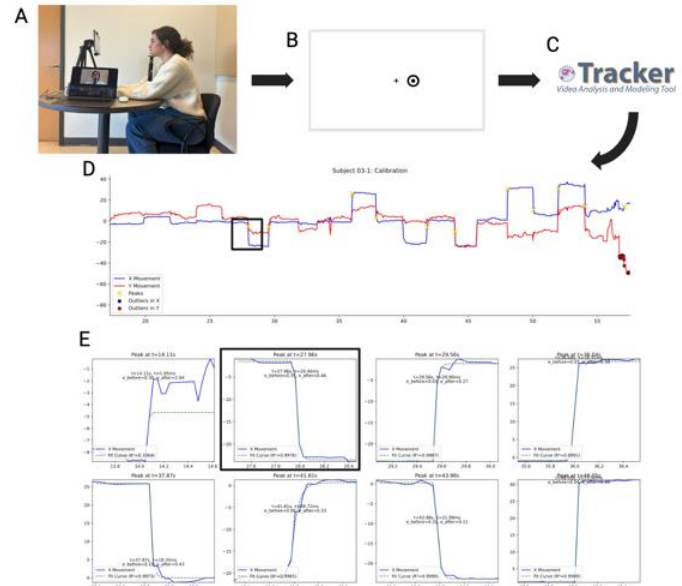
Aim: The objective of this study was to determine the extent of correlation between quantifiable measures of eye-tracking and the VOMS test score in concussed subjects.

Methods: Participants completed the VOMS test before a series of saccadic visual tasks, the eye-tracking was then processed in the open-source Tracker software and run through a code that detected the eye transitions (Figure 1).

Expected Results: It is predicted that there will be a positive correlation between the eye-tracking metrics and the VOMS test score. As well, that increased measures of tau (ms) and error (%) will be seen shortly after sustaining a concussion and will improve throughout the recovery period (Figure 2).

Figure 1: Overview of experimental protocol. (A) Subject setup. (B) Stimuli screen. (C) Open-source Tracker modeling tool. (D) Python code produced the x and y displacement of the eye. (E) The R^2 value, tau, start and end error were calculated for each transition.
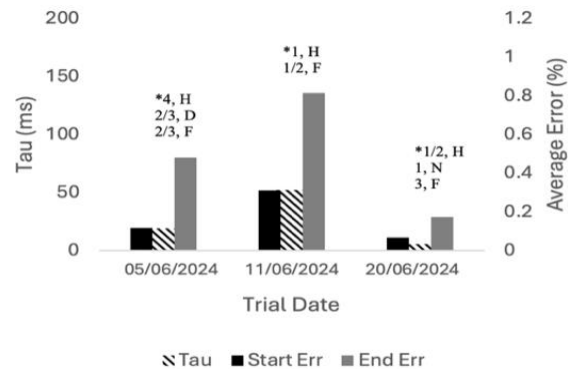
Figure 2: The average tau (ms) and error (%) values for a concussed subject during a saccadic exercise. Subject sustained a concussion on 17-02-2024, followed by 3 trial dates. The asterisk (*) represents the VOMS score, where headache (H), dizziness (D), nausea (N), and fogginess (F) are indicated on a scale from 0-10.

References:
[1] **Knell, G. et al.** (2021). Evaluation of the VOMS as a prognostic tool for protracted recovery following pediatric sports-related concussion. *BMJ Open Sport Exerc Med* **7**, e000970.
[2] **Kontos, A. P. et al.** (2021). Test-retest reliability of the VOMS tool and mBESS in US military personnel. *J Sci Med Sport* **24**, 264-268.