USE OF EYE-TRACKING AND PUPILLOMETRY TO DETECT EFFECTS OF BLAST EXPOSURES

John King[1,2], Brian Johnson[2], Kyle Knicely[3], Charles Moore[3], John O'Donnell[4], Amit Bagchi[4], Alis Kranfli[2,5], Jonathan Salib[2,5], Maciej Skotak[2,5], Anthony Misistia[2,5], Ilsse Salinas[2,5], Bradley Garfield[2,5], Christina LaValle[2,5], Dong Zhang[6], Walter Carr[2]

[1]Oak Ridge Institute for Science and Education, Oak Ridge, TN;
[2]Blast-Induced Neurotrauma, Center for Military Psychiatry and Neuroscience, Walter Reed Army Institute of Research, Silver Spring, MD;
[3]75th Ranger Regiment, Fort Benning, Columbus, GA;
[4]Naval Research Laboratory, Washington D.C.;
[5]KATMAI Health Services, Orlando, FL
[6]Bloomsburg University of Pennsylvania, Bloomsburg, PA

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ABSTRACT

Since the late 1800's, it has been known that disruptions of neural pathways are associated with dysfunctional eye movements. Technological advancements have greatly improved detectability of these abnormalities via the use of computerized eye-tracking. In 2009 Heitger et al. reported that oculomotor testing demonstrated sensitivity to traumatic brain injury (TBI) beyond that of neuropsychological testing, expanding the use of eye-tracking assessment to the TBI realm[1]. Since then, reports from numerous studies have supported the utility of eye-tracking assessment in the evaluation of athletes following concussions while others have demonstrated successful use of eye-tracking assessment in monitoring recovery in concussed athletes. Although injuries from impact are of importance to the military population, blast injuries are a separate concern as they are unique from impact injuries and yet can also harm the brain. Considering that complaints consistent with the vestibular system (dizziness, imbalance, light-headedness to name a few) are common in blast injuries, it is logical that eye-tracking assessment would also be sensitive to the effects of blast exposure. For example, pupillary light reflexes were found to be degraded in mortarmen following three days of training exercises when compared to non-exposed controls[2]. Recently, the Environmental Sensors in Training team at Walter Reed Army Institute of Research has partnered with several military units to evaluate the relation between overpressure exposure experienced during weapons fire and outcome measures. For these collaborative efforts, subjects participating in training exercises as well as non-exposed controls underwent eye-tracking and pupillometry testing prior to and following training evolutions. For subjects participating in the weapons training, blast-exposure measurements were obtained from which cumulative exposure levels were calculated. For all participants, post-exposure performance was compared to baseline (pre-exposure) performance to determine any shifts in performances, which were then compared to their exposure levels. Data collected and analyzed support the findings by Woodall et al.[2] that pupillometry is sensitive to blast exposure and the data provide compelling evidence that other eye-tracking assessments are likewise sensitive to blast exposures, even among a cohort who are not clinically diagnosed and are considered normal, healthy, and fit for duty. Overall, our experience suggests that eye-tracking and/or pupillometry have value for detection and tracking of blast-related exposure effects on the brain.

REFERENCES

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