

# AUTONOMIC PUPILLARY LIGHT REFLEX (PLR) MARKERS IN PEDIATRIC PATIENTS AFTER MILD TRAUMATIC BRAIN INJURY (MTBI)

**Authors:** Alicia Chen, BS<sup>01</sup>, Tyler Marx, MS<sup>02</sup>, Saikaashyap Sarva, MBS<sup>03</sup>, Kate Paulsen BS<sup>04</sup> Arvind Balaji, MD<sup>05</sup>, Brett Dusenberry, MD<sup>05</sup>, James Dill, MD<sup>05</sup>, Cindy Ong MD<sup>05</sup>, Leslie Streeter, DNP<sup>05</sup>, Leila Samsam, DNP<sup>05</sup>, Jaden Bailey PA-C<sup>05</sup>, Tanya Polec, OD<sup>05</sup>, Hector Rieiro, PhD<sup>05</sup>, Jon Minor MD<sup>06</sup>, Mo Mortazavi, MD<sup>05</sup>.

**Affiliations:** Burrell College of Osteopathic Medicine NM, USA<sup>01</sup>, Midwestern College of Osteopathic Medicine AZ, USA<sup>02</sup>, Rutgers University NJ, USA<sup>03</sup>, University of Iowa, IA, USA<sup>04</sup> SPARCC Sports Medicine, Rehabilitation, and Concussion Center, AZ, USA<sup>05</sup>, University of the Pacific, CA, USA<sup>06</sup>.

## **Background:**

The size of our pupils changes in the presence of light allowing us to adapt to our environment in what is known as the pupillary light reflex (PLR). The presence of a PLR is indicative of an intact autonomic nervous system. Numerous studies have looked at PLR changes after a concussion. Changes in PLR are suggestive of a blunted autonomic response. (1,2,3)

## **Purpose/Aim:**

Assess PLR autonomic response in pediatric mild traumatic brain injury (mTBI). We hypothesize that mTBIs will have a slower and smaller change in pupil size compared to non-mTBI patients.

## **Methods and Study Design:**

A retrospective cohort study of 50 pediatric patients who had 167 total clinical visits for concussive symptoms between 11/19/19 and 06/21/22. Fifty patients with a total of 167 visits were included in this study. Ages ranged from 6 to 21 years of age that visited the clinic within 156 days of injury. A standardized tablet-based application was utilized at every visit to obtain PLR measures focused on maximum pupillary diameter (MaxPD) (mm), minimum pupillary diameter (MinPD) (mm), and maximum constriction velocity (MCV) (mm/s). Normative values from a control group totaling 4,487 tests were broken down into three age ranges: 6-11, 12-17, and 18-21, respectively.

**Results:** The age correlated mean MaxPD was  $6.67 \pm 1.25$ ,  $6.47 \pm 1.40$ , and  $6.31 \pm 0.97$ , MinPD  $3.92 \pm 0.52$ ,  $4.08 \pm 0.72$ , and  $4.12 \pm 0.64$ , MCV  $13.06 \pm 7.38$ ,  $12.17 \pm 7.55$ , and  $12.68 \pm 6.16$ , respective to 6-11, 12-17, and 18-21. P values for mean MaxPD was  $<0.0001$ ,  $<0.0001$ , and  $0.0002$ , MinPD were all  $<0.0001$ , MCV  $0.0009$ ,  $<0.0001$ , and  $<0.0001$ , all significant with respect to the age groups.

**Conclusion:** PLR is potentially a quick and useful marker for post-concussive evaluation and autonomic assessment. Based on our population, MaxPD, MinPD, and MCV all showed to be accurate biomarkers of suggested blunted autonomic response in the pediatric mTBI group.

**Acknowledgements:** The Reflex team for the use of their technology.

**Future directions (for poster/ppt):**

Autonomic dysfunction is common post-concussion and difficult to evaluate or identify. Tools like PLR can assist in this assessment and help guide autonomic treatments and counseling. Autonomic dysfunction has been commonly implicated in post-concussive positional and exertional intolerance amongst many other potential symptoms. Guidance in these areas may be critical to avoid symptom aggravation, prolonged symptoms, and re-injury, as well as promote an optimal recovery timeline.

Ref:

1- Master et al. Utility of Pupillary Light Reflex Metrics as a Physiological Biomarker for Adolescent Sport-Related Concussion. *JAMA Ophthalmol.* 2020;138(11):1135-1141.  
doi:10.1001/jamaophthalmol.2020.3466

2- Carrick et al. The Pupillary Light Reflex as a Biomarker of Concussion. *Life* 2021, 11, 1101.  
DOI: 10.3390/life