Normative Pupillometry Data in Healthy Pediatric Patients from 1-17 Years of Age

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Background

• An assessment of pain and analgesic response can be particularly challenging in the pediatric population.
• Precise information on pupil size and reactivity to light can be captured using a handheld pupillometer.
• The non-invasive technique has been validated for use in a few pediatric studies1-3. A study by Children’s Mercy Hospital (CMH) has provided proof of concept for the use of pupillometry as a functional pharmacodynamic biomarker to quantify severity of pain and predict opiate necessity4.

Methods

• This was a pediatric prospective study of healthy children ages 1-17 years.
• Convenience sampling at CMH outpatient clinics was performed.
• Exclusion criteria:
  (a) Major chronic illness that might affect pupil size
  (b) Currently in pain
  (c) Taking any medication known to affect pupil size including analgesics
  (d) Unwilling/unable to participate
• Age, sex, and race were obtained using a brief questionnaire.
• Pupil size and reactivity were measured using a NeurOptics PLR-200 pupillometer (NeurOptics, Irvine, California).
• We obtained an average of three consecutive readings to quantify maximum and minimum pupil size, constriction velocity, and dilation velocity.
• Data were analyzed using least squares linear regression analysis.

Results

• Two-hundred five participants (52% male) were included in the data analysis.
• Self-identified patients’ race distribution was 63% Caucasian, 30% Black, and 7% other.
• Neither maximum or minimum pupil size appeared to appreciably change as a function of age ($R^2 = .087, R^2 = .038$).
• Other parameters (minimum pupil size, constriction velocity/dilation) did not appear to change as a function of age ($R^2$ values < 0.2, p values < 0.05).
• There were no appreciable differences between males and females in any of the pupillometry values.

Conclusion

• Pupil size appears to have little association with age in healthy pediatric patients ages 1-17.
• Pupil reactivity was not influenced by ontogeny, and reactivity is the primary determinant to quantitate pain severity and treatment response.
• These data provide an important baseline and are critical considerations for interpretation of future pediatric studies using pupillometry as a pharmacodynamic biomarker.

References