Development of Portable Pupillometer for Assessment of Neurological Disease

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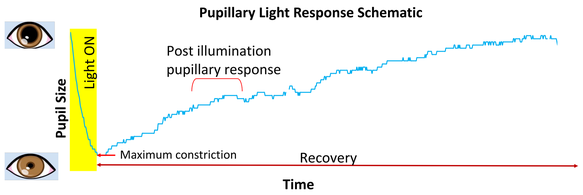
BACKGROUND

- Pupil reactivity is an important clinical marker of optic nerve function
- Quantitative pupillometry may offer advantages over the qualitative clinical pupil exam.
- Current commercial devices that provide this metric are cumbersome, expensive, and require operator expertise.

PURPOSE

- To configure and validate the use of portable device to perform quantitative pupillometry.

PROTOCOL DEVELOPMENT



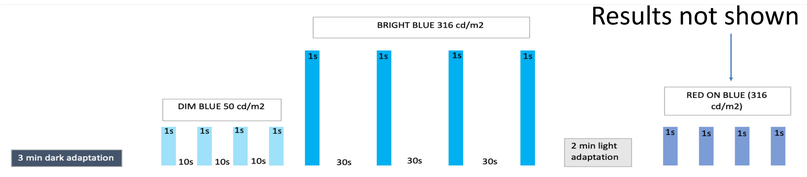
Light stimulation and pupil recording protocols were implemented using the retEVAL device (LKC Technologies Inc) using the Lua programming language

Protocols implemented follow those used by Park et al.

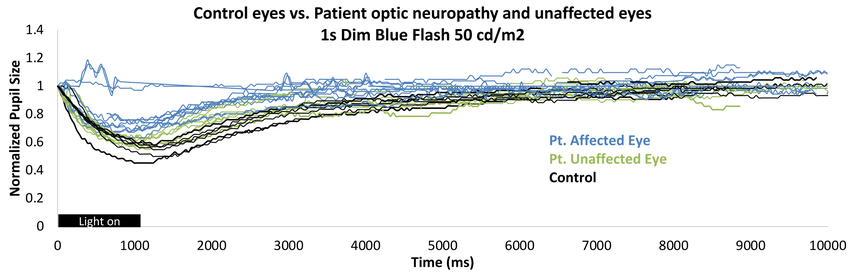
VALIDATION IN PATIENTS

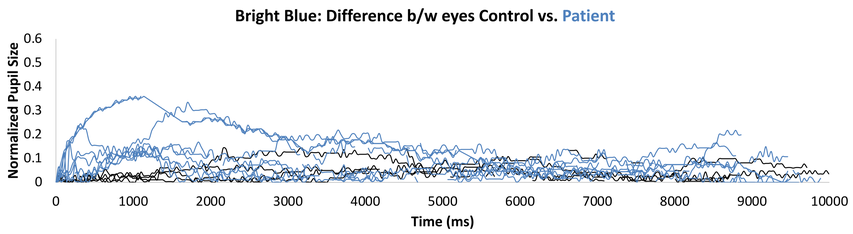
METHODS:

- Following a 3 min dark adaptation, a series of dim blue, bright blue, and red on blue (purple) flashes of 1s duration was presented to 10 patients with unilateral optic neuropathy (6 NAION, 2NMO, 1 Inflammatory ON, 1 Meningioma) and 5 healthy control subjects (3 female, age 20-60)
- 10s recovery after each dim blue and purple flash. 30s recovery for bright blue.

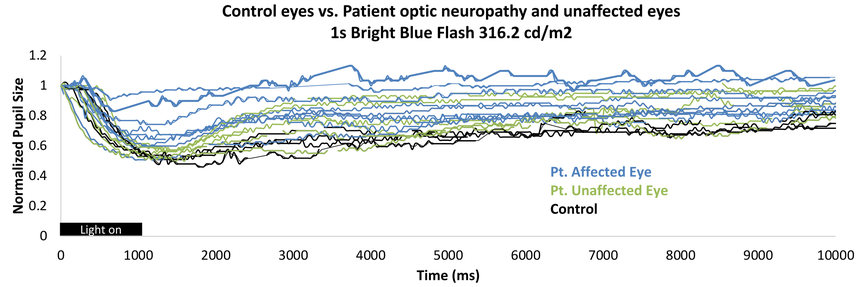


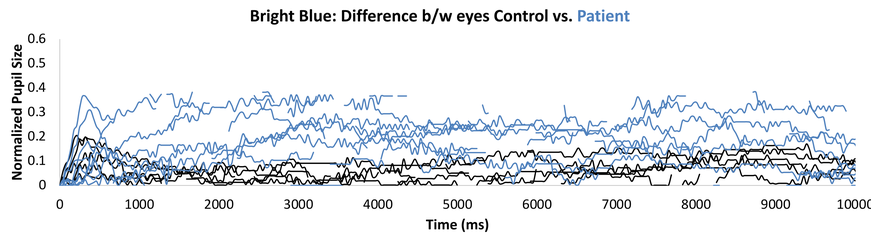
DIM BLUE





BRIGHT BLUE





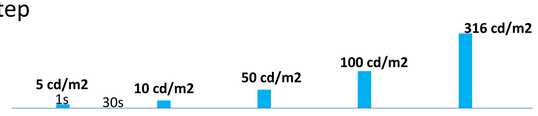
RESULTS: Max constriction decreased in affected patient eyes and difference in max constriction between eyes more pronounced in patients

VALIDATION IN CONTROLS

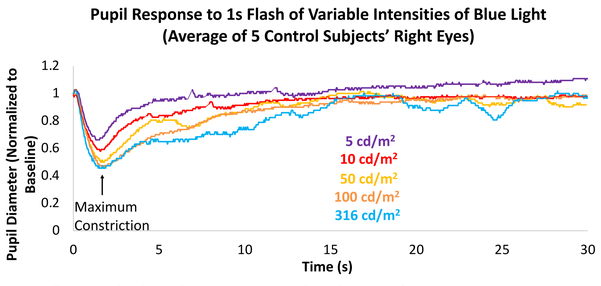
MANIPULATION OF INTENSITY

METHODS:

- Following a 3 min dark adaption, a series of 1s blue flashes of varying intensities was presented to five healthy control subjects (2 female, age 20-30) . 30s recovery was implemented between each intensity step



RESULTS:

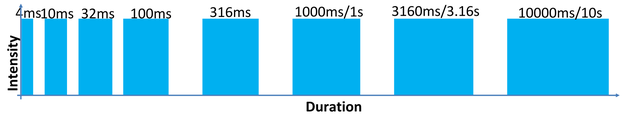


- Constriction increased with intensity
- PIPR decreased with intensity
- Similar to published results

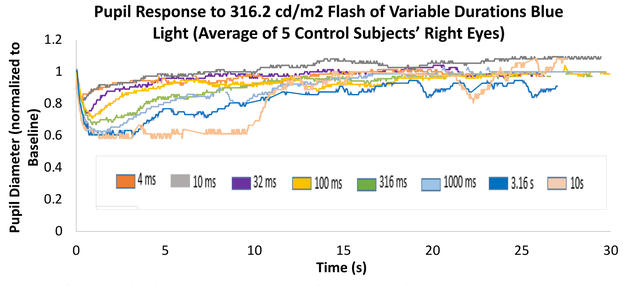
MANIPULATION OF DURATION

METHODS:

- Following a 3 min dark adaption, a series of 316.2 cd/m^2 blue flashes of varying durations was presented to five healthy control subject.
- 30s -60s recovery between duration steps



RESULTS:



- Constriction increased with duration to a floor
- Similar to published results

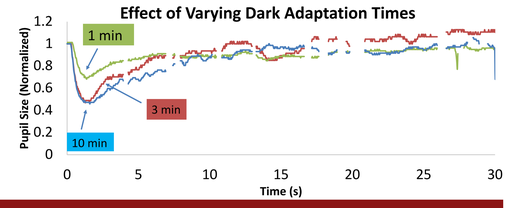
EFFECT OF DARK ADAPTATION

METHODS:

- Effect of dark adaptation times (1,3,10min) on response to a 1s bright blue flashes (316.2 cd/m2) was evaluated in 1 subject

RESULTS:

- 1 min dark adaptation was associated with smaller MPC and PIPR.
- 3min dark adaptation was similar to 10min.



CONCLUSIONS

- Similar to published results using gold standard desktop pupillometry, our protocol measured
  - Both maximum and post illumination pupillary responses to a blue stimulus to be accentuated for higher intensity and duration stimuli in healthy controls
  - Maximum constriction to a 1s bright and dim blue stimuli to be reduced in eyes with optic neuropathy compared with fellow eyes and control subject eyes.
- The portable pupilometer is practical for use in the clinical setting.

FUTURE DIRECTIONS

- A portable pupillometer might be useful in the clinic and research setting for diagnosis and monitoring of optic neuropathies and neurological disease.
- Additional studies are needed to establish the normal range of responses and the clinical role in diagnosis and monitoring.

REFERENCES

- Park JC, Moura AL, Raza AS, Rhee DW, Kardon RH, Hood DC. Toward a clinical protocol for assessing rod, cone, and melanopsin contributions to the human pupil response. Invest Ophthalmol Vis Sci. 2011 Aug 22;52(9):6624-35. doi: 10.1167/iovs.11-7586. PubMed PMID: 21743008; PubMed Central PMCID: PMC3175993.

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