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An electronic device to record consensual reflex in human pupil

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Abstract

Examination of the pupil offers an objective evaluation of visual function as well as the vegetative pathways to the eye. This work proposes the development of an effective method and a portable device to test the consensual pupillary reflex. The first results demonstrate the success of a new device construction and methodology to record the consensual reflex with different stimulus, in a situation of complete blockage of light.

Keywords:
Consensual Reflex; Pupillometry; Computer-aided diagnosis.

Introduction

The pupillary inspection is a valuable part of the ophthalmological, neurological and general medical examinations routine [1]. Pupillary examination involves recording the size, symmetry, and light reactivity of both pupils [2].

Materials and Methods

To apply the test methodology, a pupilometer was built based on consensual human optics reflection. The Pupilometer has a lighting system with visible light that gradually goes from 0 (zero) to 38 lux, positioned at a 3 centimeters distance from one of the eyes and completely seals illumination as shown in Figure 1 (a). The four metrics used to test methodology were amplitude, latency, time to maximum contraction (TMC), time to maximum dilation (TMD). Twenty-nine volunteers' participated and 61 records were made, with 1 to 5 recordings for each volunteer. Eight volunteers were females (27.58%) and 21 males (72.41%). Through the software it was possible to set visual stimulus duration, intensity and choose which eye should be recorded.

Results

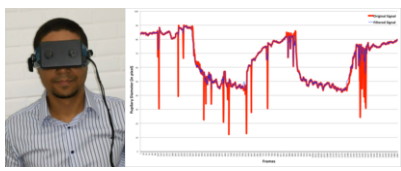
Table 1 shows the mean and standard deviation of the tests performed with 61 videos.

Table 1 – Configuration of visual stimulus

Parameter	1st Period		2nd Period	
	Mean	SD	Mean	SD
Amplitude	0.58%	0.09%	0.59%	0.08%
Latency	0.33 seg	0.57 seg	0.24 seg	0.10 seg
TMC	1.67 seg	0.37 seg	1.57 seg	0.41 seg
TMD	1.84 seg	0.29 seg	1.85 seg	0.27 seg

Discussion

In some cases, the volunteer movements caused failures on pupil segmentation and, therefore, caused noise in the signal. To correct them, the software used the neighborhood average algorithm, resulting in a sign like shown in Figure 1 (b).



(a) (b)

Figure 1 – (a) Volunteer using the pupilometer, (b) Example of the algorithm application by software

Conclusion

The Pupilometer and the software proved to be an effective, non-invasive and portable pupillary behavior after light stimulus identification method, being a useful tool to integrate in the clinical, emergency, ophthalmology and neurology related medical routine. It is necessary to conduct more clinical investigations to determine pathological patterns in patients with diseases. This work can also open a way to new studies involving computer-aided diagnosis (CAD). Changes in the software could make possible studies to identify signs of a probable disease.

References

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