

*Research paper

Reliability and Comparison of Corneal Reflex Measurement with Plusoptix S08 in Nonstrabismic Amblyopic Children

Short Title: Corneal Reflex Reliability of Plusoptix S08

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All patients provided informed consent from the parents in accordance with the Declaration of Helsinki, and institutional review board approval was obtained from the hospital ethics committee.

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ABSTRACT

Purpose: In this prospective study our purpose is to measure how much the corneal reflex measurement by photoscreener Plusoptix S08 is reliable in anisometropic nonstrabismic amblyopic children by comparing them with unamblyopic childrens corneal reflex measurements.

Methods: 39 amblyopic non strabismic children and 28 normal childrens corneal reflex values are compared after complete ophthalmoscopic examination by the same examiner. Only patients with anisometropic amblyopia without strabismus included in the study group and only non amblyopic children included in the control group.

Results: There was no statistical significance between study and control group in means of age $p=0,100$ and sex distribution $p=0,818$. Corneal reflex values of the amblyopic eyes was $3,8\pm 3,2$ and corneal reflex values of normal eyes was $2,4\pm 4,1$. There was no statistical significance between study and control group in means of corneal reflex values $p=0,127$.

Conclusions: Although plusoptix is proved to be a reliable screener in terms of measurement of refraction. We did not know if the corneal reflex value was also a reliable screening value because there is no research about this value in the literature. According to current literature this is the first research examining corneal light reflex reliability of a plusoptix S08 photoscreener and in the light of our results corneal reflex value of plusoptix S08 is not a reliable tool in screening of amblyogenic risk factors in non strabismic children.

Key words: Plusoptix, Amblyopia, Bruckner Test, Anisometropia

Reliability and Comparison of Corneal Reflex Measurement with Plusoptix S08 in Nonstrabismic Amblyopic Children

INTRODUCTION

Amblyopia is defined as the decreased visual acuity, either unilaterally or bilaterally in spite of any refractive error being neutralized with lenses and in the absence of detectable eye disease, the acuity of the eye is still below normal, which is resulting from a disturbance in retinal image formation during the first decade of human life¹ (1-3). Depending on the population studied, prevalence of amblyopia is difficult to assess and varies in the literature, ranging from 1-3.5% in healthy children to 4-5.3% in children with ophthalmic problems and is a significant preventable cause of vision loss in children and adults. (4-6) Amblyogenic risk factors include anisometropia, isoametropia, strabismus, media opacity, and ptosis. If treated on time, it can be fully reversible so that how early it is detected is very important. There are two screening tools that can be used by a non ophthalmologist in preverbal and nonverbal children which are Bruckner reflex and photoscreening. The Bruckner reflex involves utilization of a direct ophthalmoscope in an undilated patient to compare the pupillary red reflexes for asymmetry of color and brightness.(7-9) Roe et al demonstrated that if the patient's fovea is not exactly conjugate to the light source, light from the retina spills past the light source at the ophthalmoscope mirror into the examiner's eye, creating the red reflex.(10,11)Therefore, binocular asymmetry of this conjugate relationship between the 2 eyes is strongly predictive of the amblyogenic risk factors of anisometropia, strabismus, or media opacity. The Bruckner reflex alone has a high sensitivity for the detection of children with amblyopia (67 of 70 children; 95%).(7) It is also quite sensitive for the detection of conditions likely to result in amblyopia. (12)

In the 1994 Cibis and Tongue described a digitizable analog video system combining Brückner pupil red reflex imaging with eccentric photorefractometry for video screening of young children for amblyogenic factors.(7,8) Since then video photoscreening developed greatly. The Vision Screener® (Plusoptix- Germany) was developed for the recognition of amblyogenic refractive errors without cycloplegia. Its high reliability and reproducibility of screening refractive errors as a photoscreener are discussed elsewhere. (13-16)

Of the commercially available photoscreening instruments available, the most prominent are the MTI Photoscreener, the iScreen Photoscreener and the Plus OptixSO8 Photoscreener. The MTI Photoscreener and the iScreen Photoscreener require manual interpretation of the flash reflections and difficulties with interpretation currently limit the acceptance of photoscreening technology for

widespread screening, But plusoptix S08 does not need advanced experience thus can be used for screening of large populations.

In this study our purpose is to measure how much the corneal reflex measurement by photoscreener Plusoptix S08 is reliable in anisometropic nonstrabismic ambliopic children by comparing them with unambliopic childrens corneal reflex measurements.

METHOD

In this prospective study we compared corneal reflex values of 39 ambliopic non strabismic children measured by Plusoptix S08 (PlusoptixVision Screener®- Germany) with 28 normal childrens corneal reflex values. All patients provided informed consent from the parents in accordance with the Declaration of Helsinki, and institutional review board approval was obtained from the hospital ethics committee. All patients underwent a complete ophthalmoscopic examination by the same examiner. Examination included refractive measurement, visual acuity testing with Lea symbols and/or Snellen chart, hirschberg test, synoptophor test, and plusoptix S08 test. Patients with any history of trauma, ocular pathology and strabismus were not included in the study. Only patients with anisometropic amblyopia without strabismus included in the study group and only non amblyopic children included in the control group.

STATISTICAL METHOD

As a statistical method frequency, ratio, mean and standard deviations are used. In the distribution of data Kolmogorov-Smirnov test is used for control. In the analysis of variables independent Sampling t Test is used. Chi-square test is used for analysis of ratios. In all statistics SPSS (version 20.0 for Windows, SPSS Inc., Chicago, IL, USA) program is used.

RESULTS

The patient number included in study group was 39 (22 female, 17 male) and control group 28 (15 female, 13 male) Table 1. The mean age of study group was $11,4 \pm 8,4$ and control group was $8,3 \pm 6,2$. There was no statistical significance between study and control group in means of age $p=0,100$ and sex distribution $p=0,818$.(Table 1). Corneal reflex values of the ambliopic eyes was $3,8 \pm 3,2$ and corneal reflex values of normal eyes was $2,4 \pm 4,1$. As seen on Table 2 and Figure 1 there was no statistical significance between study and control group in means of corneal reflex values $p=0,127$.

DISCUSSION

Bruckner test is a valuable tool that helps to detect fundus disorders, myopia, anisometropia and large-angle strabismus. It involves using an ophthalmoscope to compare the red reflexes between two eyes, from nearly arm length. When both eyes fixate and focus on the ophthalmoscope light, both pupils constrict, the corneal light reflexes become centered, and both red reflexes become quite dark. If there is brightness difference between two reflexes, it means that there is asymmetry.(7,17) In many studies the sensitivity of the Brückner test was found to be real high as 82-87.5% and specificity 84.1-91 %; the positive (PPV) and negative predictive (NPV) value was 71.8% and 93.6% interestingly accuracy was 84 % (18,19)In another study by cole et al. the Bruckner reflex alone had a high sensitivity for the detection of children with amblyopia (67 of 70 children; 95%). (12)

In the 1994 Transactions of the American Ophthalmological Society, Cibis described a digitizable analog video system combining Brückner pupil red reflex imaging with eccentric photorefractometry for video screening of young children for amblyogenic factors.(8) The principle behind photoscreening is off-axis photorefractometry. A light source eccentric to the eye-camera axis gives rise to crescents within the pupils. The dimension of the dark crescent is correlated with the magnitude of the refractive error. In plusoptix this is shown by a value of corneal reflex. Images obtained from the position of the corneal light reflex and the overall reflection of the light from the fundus (Bruckner reflex test) are then analyzed.(7,8,20,21)

There are two types of photoscreeners exist, each based on the relationship between the flash source and the optical axis of the camera: the on-axis system, which has a coaxial camera and flash source, and the off-axis system, which has a flash source slightly off the optical axis of the camera. In some photoscreeners the well known MTI Photoscreener and the iScreen Photoscreener a trained reader is required to analyze the images. This is inefficient and leads to significant subjectivity and to interobserver variability but plusoptix is a digital photoscreener with computerized image analysis program(22,23). It acquires readings in as little as 1.5 seconds. It also provides a noncycloplegic autorefractometry. This feature reduces the need for an autorefractor and saves time by providing a useful starting point for performing cycloplegic refractions for children. Although assessing the magnitude of amblyopia is difficult in preliterate children, it is important to include such children in studies of amblyopia therapy, because early intervention can be effective.(24-27)

Although plusoptix is proved to be a reliable screener in terms of measurement of refraction.(13-15) We did not know if the corneal reflex value was also a reliable screening value because there is no research about this value in the literature. As we all know because definite strabismus can effect the results and corneal reflex value can not be derived in large angle strabismus especially with plusoptix S08 we have to do measurements separately in each eye, we only

studied the non strabismic cases. According to our results there was no statistical significance between two groups in means of age, sex and the corneal reflex value.

As a conclusion according to current literature this is the first research examining corneal light reflex reliability of a plusoptix S08 photoscreener and in the light of our results corneal reflex value of plusoptix S08 is not a reliable tool in screening of amblyogenic risk factors in non strabismic children.

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TABLES

Table 1 Age and sex distribution of age and sex distribution of anisometropic amblyopic eyes versus control group.

		Control Group		Anisometropic Ambliopia Group		p
		mean.±s.d. / n-%		mean.±s.d. / n-%		
Age		8,3 ± 6,2		11,4 ± 8,4		0,100
Sex	Female	15	53,6%	22	56,4%	0,818
	Male	13	46,4%	17	43,6%	

Chi-square test / Student t test

Table 2 Comparison of corneal reflex values of anisometropic amblyopic eyes versus control group.

	Control Group	Anisometropic Ambliopia Group	p
	mean.±s.d. / n-%	mean.±s.d. / n-%	
Corneal Reflex Value	2,4 ± 4,1	3,8 ± 3,2	0,127

Student t test

Graph 1. : Skeletal Box-and-Whiskers Plot representation of comparison of corneal reflex values of anisometropic amblyopic eyes versus control group.

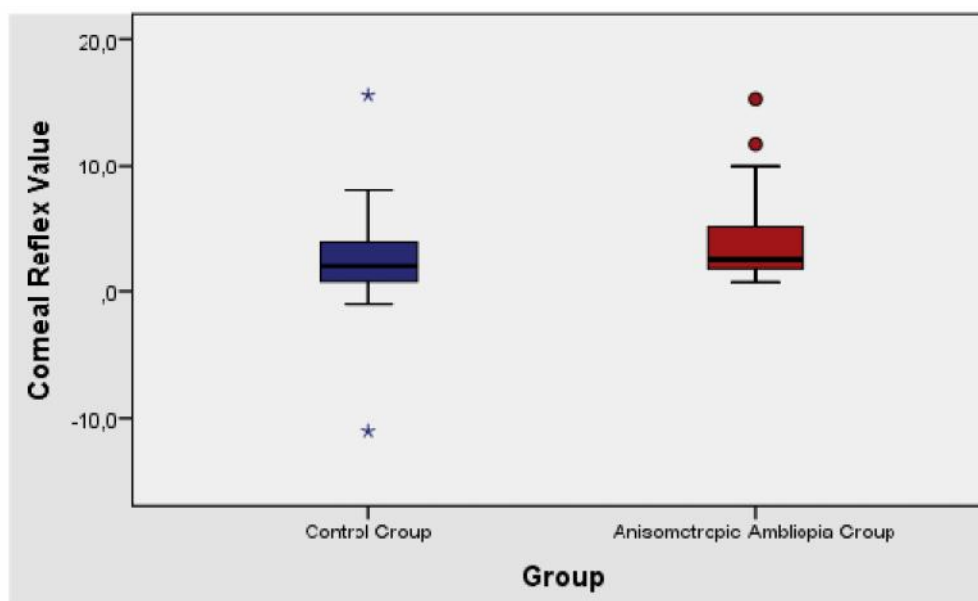


FIGURE LEGENDS

Table 1 Age and sex distribution of age and sex distribution of anisometropic ambliopic eyes versus control group.

Table 2 Comparison of corneal reflex values of anisometropic ambliopic eyes versus control group.

Graph 1. : Skeletal Box-and-Whiskers Plot representation of comparison of corneal reflex values of anisometropic ambliopic eyes versus control group.

