



BRÜCKNER TEST -RAPID SCREENING TEST TO DETECT SIGNIFICANT REFRACTIVE ERRORS IN CHILDREN

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ABSTRACT **PURPOSE:** To assess the suitability of Brückner test as a screening test to detect significant refractive errors in children. **MATERIALS AND METHODS:** 70 children prospectively observed the size and location of pupillary crescent on Brückner test as hyperopic, myopic or astigmatic. This was compared with the cycloplegic refraction. Detailed ophthalmic examination was done for all. Sensitivity, specificity, positive predictive value and negative predictive value of Brückner test were determined for the defined cutoff levels of ametropia. **RESULTS:** Seventy subjects were examined. Mean age was 8.6 years (range 1 to 16 years). Brückner test could be completed for all; the time taken to complete this test was 10 seconds per subject. It was identified 112 eyes as ametropic, 28 as emmetropic. The Brückner test had sensitivity 91%, specificity 72.8%, positive predictive value 85.5% and negative predictive value 83.6%. Of 10 false negatives four had compound hypermetropic astigmatism and three had myopia. **Conclusions:** Brückner test can be used to rapidly screen the children for significant refractive errors. The potential benefits from such use may be maximized if programs use the test with lower crescent measurement cutoffs, a crescent measurement ruler and a distance fixation target. **Key words:** Amblyopia, Brückner test, photorefractor, refractive error, vision screening

KEYWORDS :

INTRODUCTION

The Brückner test is a low-cost, simple and quick method to Materials and Methods detect anisometropia and strabismus among children. 1 Being an objective test it can be used among preverbal children and This prospective single-blind study was conducted in the patients uncooperative for alternate cover testing. One can also department of pediatric ophthalmology of a tertiary combine this technique with observations of detecting media teaching eye hospital in April 2004. The inclusion criteria opacities or performing the Cox variation of the swinging flash were- 1) age 1 to 16 years, 2) absence of media opacities, 3) light test (for afferent pupillary defect) and the detection of no anisocoria or pharmacological pupillary dilatation, 4) significant refractive errors. The test is performed using a no prior intraocular surgery 5) no nystagmus. The coaxial light source such as direct ophthalmoscope and the ophthalmologist performed Brückner's test in a dark room optical principle is essentially that used in the development one meter away from the subject. Both eyes of the subject of the photoscreener. 2,3 Guyton has elegantly described the were simultaneously illuminated using a direct optical principles of the Brückner test using beam splitter ophthalmoscope (Heine, Beta 200, Optotechnik, Germany) ophthalmoscope. 4 In this manuscript we report on the potential use of the Brückner test as a screening test to detect significant refractive errors in children the patient looking directly at the ophthalmoscope. The ophthalmologist looked through the direct ophthalmoscope and adjusted the lens dial until the pupillary reflex was sharply focused. The size and location of the pupillary crescent was noted as hyperopic, myopic or astigmatic [Table 1, Fig. 1]. This is similar to what was described for photoscreener. 5 Subsequently, a cycloplegic refraction was performed using autorefractometer (RM 6000B, Topcon, Japan). The detailed ophthalmic examination was done for all by a pediatric ophthalmologist. Sensitivity, specificity, positive predictive value and negative predictive value of Brückner test were determined for the defined cutoff levels of ametropia [Table 1].

Refractive error	Pattern of crescent	Size of crescent	True Positives
Myopia	Inferior crescent	>1mm	≥ -1 D
Astigmatism	Crescent anywhere	>1 clock hour decentered	≥ 1.5 D
Hypermetropia	Superior crescent	≥2 mm	≥ 1 D
Emmetropia	Superior crescent	>2mm	< 1D

RESULTS:

Seventy subjects were recruited. The mean age was 8.6 years (range 1 to 16 years); 43 (61%) were males. Two subjects had manifest deviation (one, alternate esotropia and one alternate Brückner test could be completed for all recruited subjects; the time taken to complete this test was approximately 10 seconds per subject. The ophthalmologist identified eyes 112 as ametropic, 28 as emmetropic [Table 2]. Myopia ranged from -1.0D to -5.75D, hypermetropia ranged from +1.0D to

+5.25D and astigmatism ranged from 1.5D to 5.25D The sensitivity, specificity and other parameters of the Brückner test were calculated [Table 3]. Of 10 false negatives four had compound hypermetropic astigmatism (mean cylinder +1.25D, range +1 to +2.5D) and three had myopia (mean -1.5D, range -1 to -2.5D).

Table 2: Distribution of the eyes for the Brückner test and the cycloplegic autorefraction

Brückner test Cycloplegic-autorefraction

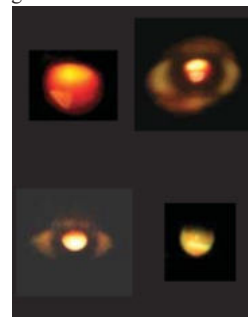
(n=192)	Ametropia	Emmetropia	Total
Ametropia	93	19	112
Emmetropia	8	20	28
Total	101	39	140

Table 3: Results of the evaluation of the Brückner test Sensitivity

Sensitivity	91%
Specificity	72.8%
Positive predictive value	85.5%
Negative predictive value	83.6%
False positive rate	16.4%
False negative rate	14.5%

DISCUSSION:

Data from our study suggests that the Brückner test can be used to screen refractive errors. The potential benefits from such use may be maximized if programs use the test with lower crescent measurement cutoffs, a crescent measurement ruler and distance fixation target In 1961 Brückner described a low-cost test to perform screening for amblyopia. 6 We found advantages with the Brückner test – 1) it is relatively easy and simple test to administer, 2) can train persons with no or minimal prior Negative predictive value 83.6% experience to administer the test, 3) can be administered using only a direct ophthalmoscope minimizing costs when compared to a photoscreener, 4) can potentially screen a large population within a short period as the test does not take long to administer



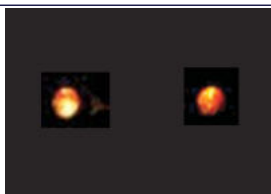
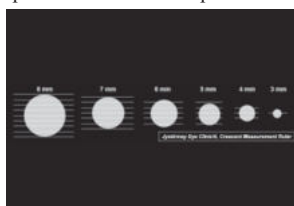


Figure 1: Observations on Brückner test. (a) Bright crescent 2 mm in size visible superiorly in the pupillary area (b) Bright crescent >2 mm in size visible superiorly in the pupillary area of a hypermetropic eye c) Bright crescent >1 mm in size visible inferiorly in the pupillary area of a myopic eye. (d) Bright inferior crescent >1 clock hour decentered in the pupillary area of an eye with myopic astigmatism (e) Bright inferior crescent in the right eye and superior Sensitivity 91% crescent in the left eye in a patient with anisometropia.



5) the test has good sensitivity 6) with experience the sensitivity and specificity improves 7) the investigator can proceed with the additional examination using the same ophthalmoscope.

However, the test also has limitations. A major limitation is difficulty in quantifying the results. This difficulty may also cause inter-observer and intra-observer variations. We were unable to explore this possibility as the duration of our study was short. We do not have data on repeat measurements on the same subjects limiting our ability to comment on the reliability of the test.

The difficulty in recording the results of the test can also be reduced by using crescent measurement rulers [Fig. 2]. The crescent measurement rulers are used to interpret photographs taken from the photoscreeners⁷ and can improve the specificity when used in conjunction with the Brückner test.

We found that lack of accommodative control and absence of distance fixation target can cause pseudomyopia that can reduce the specificity and predictive value of the positive test. We are now using large visual targets that fluoresce in the dark fixed at a distance of three meters while performing the Brückner test. This attracts the child's attention and is sufficient to allow the examiner to adequately perform the test. However, the optical principles would follow that of an off-axis photorefractive utilized for some photoscreeners.

Though we did not have a patient with high ametropia we are aware that patients with high myopia have a dark fundal glow and patients with high hypermetropia have a bright fundal glow. In both the situations there is an absence of the crescent. The examiner should be aware of this situation and diagnose these patients as having high ametropia.

Variability in the pigmentation of the fundus has previously been reported to affect the sensitivity of the Brückner test⁸ when used to detect amblyogenic factors—darker fundus pigmentation is associated with lower sensitivity. It is not clear what effect pigmentation of the fundus may have on the Brückner test when used to detect refractive errors. Also the test is rendered useless with dilated pupil.^{8,9}

We are concerned about the relatively low negative predictive value obtained for the test in our study—this is mainly of concern for the four eyes with significant astigmatism for its potential to cause amblyopia. The potential cause of this could be lack of accommodative distance fixation target that can mask astigmatism. This limitation can be overcome with experience and the use of an appropriate target at the distance. Also, the Brückner test provides possibilities to introduce lower cutoffs for the crescent size that may improve sensitivity and negative predictive value at the cost of increasing the false positives. The issue of false positives is of importance, as these subjects are brought back to the clinic for more sophisticated and often more expensive tests, placing an additional burden on healthcare programs. Hence the examiners must decide

cutoffs to provide maximum effectiveness to the screening program.

The positive predictive value for the test was high in our study and the specificity value was 73% suggesting potential to improve the specificity for this test, thus improving the predictive value. It is possible that the specificity of the test may increase as the experience of those administering the test increases.

Further studies are required to see how the test will function to screen for refractive errors with 1) distance fixation target,

2) different cutoff levels for the diagnosis of ametropia and 3) use of a crescent measurement ruler. Studies are also required to compare the cost-effectiveness and cost benefits from screening with Brückner and photoscreeners.

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