

# Use of Bruckner Test for the Detection of Significant Refractive Errors in Children

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## Abstract

**Background :** To evaluate the potential use of the Bruckner test to detect significant refractive errors in infants and children.

**Methods:** In this prospective study Bruckner test was performed, in children upto 15 years of age, with direct ophthalmoscope and position and size of pupillary crescent was noted. Subsequently, non-cycloplegic and cycloplegic auto-refraction was performed using auto-refractometer. Children were classified according to errors of refraction, Emmetropic, Myopic and Hyperopic.

**Results:** Total 102 children were included, 56 males and 46 females with mean age of 8.38 years. Results of Bruckner test, revealed 50 (49.0%) right eyes hyperopic and 35(34.3%) myopic, 53 (51.9%) left eyes were hyperopic and 36 (35.2%) myopic. Cycloplegic auto-refraction revealed significant hyperopia in 48 and 50 right and left eyes respectively. Significant Myopia was detected in 30 and 27 right and left eyes. The sensitivity and specificity of Bruckner test to detect refractive errors in children was found to be 97% and 79% respectively.

**Conclusion:** The Bruckner test has potential usefulness, reasonable accuracy, timeliness and simplicity as a screening test to detect refractive errors in children.

**Key Words:** Bruckner test, Refractive errors, Auto-refraction.

## Introduction

Refractive errors are common causes of visual impairment worldwide in children; and may lead to amblyopia, difficulty in academic pursuits and low productivity. The presence of uncorrected refractive errors may be difficult to identify in young children as they don't complain. Refractive error is an error in focusing of light by the eye from an object onto the retinal plane and is one of the most common causes of visual impairment worldwide. Refractive error can be divided into myopia, hyperopia, and astigmatism.<sup>1</sup> It is estimated that 2.3 billion people worldwide have refractive errors and it accounts for 11.4% of the total

visual impairment in Pakistan. Pakistan's national survey of blindness and visual impairment in 2002–2004 reported that over 40,000 people are blind in Pakistan due to uncorrected refractive errors.<sup>2</sup>

Refractive errors can have many problems especially with children including educational loss, low productivity and impaired quality of life.<sup>3</sup> In Pakistan, there is no established vision screening programme for children on admission in school and children with learning difficulties are often brought to pediatrician or ophthalmologist for evaluation to see whether an ocular disorder is responsible for the disability. Snellen chart along with cycloplegic refraction is gold standard to detect refractive errors, but in children it needs special skill requiring time, patience and understanding.<sup>4</sup>

Bruckner test is vital for early detection of refractive errors especially in children. It uses the transmission of light from an ophthalmoscope through the eye which reflects off the ocular fundus and transmitted back through the ophthalmoscope and imaged in the eye of the examiner as red reflex.<sup>5</sup> An abnormal red reflex may be present in corneal or vitreous opacities, foreign bodies, iris abnormalities, cataracts, retinal abnormalities or tumors, refractive errors and strabismus. Emmetropic eyes reveal a homogeneous red reflex that fills the pupil whereas inferior crescent is present in patients with myopia, superior crescent in patients with hyperopia, any asymmetry of the reflex indicates anisometropia.<sup>6</sup>

Significant refractive errors are the most prevalent and treatable vision problems in children and presence of uncorrected refractive errors may be difficult to identify in young children. The American Academy of Pediatrics currently recommends red reflex assessment as a component of the eye evaluation in the neonatal period and during all subsequent routine health supervision visits<sup>7</sup>. Refractive error requires detection and treatment in the form of glasses, contact lenses or refractive surgery.

The screening tests of refraction used in children to identify significant refractive error include non-cycloplegic refraction which needs a high degree of

training, skill, and clinical knowledge, and cycloplegic auto-refraction needs automated refractor which is not usually available at all basic healthcare levels. <sup>8</sup> In very young children, conventional auto-refractor can not be used and hand held refractometer is not available in every setup.

### Subjects and Methods

It was a prospective study done at a private eye hospital in Rawalpindi, from July 2015 to September 2015. Children up to 15 years of age, both sex and whose parents had endorsed informed consent were included. Those having ocular media opacities, previous history of ocular surgery or nystagmus were excluded.

Initially the Bruckner test was performed, by ophthalmologist for all the children in a dark room, using an ophthalmoscope (Heine Germany Beta 200) from a distance of one meter. Both eyes were illuminated simultaneously by ophthalmoscope while the child looking at six meter distant object and the lens dial was adjusted till the papillary red reflex was focused. The position and size of papillary crescent was noted and labelled as: emmetropia; low, moderate or high myopia; low, moderate or high hyperopia (Table I). Any asymmetry of the reflex between the two eyes was labelled as anisometropia.

After Bruckner test, non-cycloplegic auto-refraction was performed in all the children and then cycloplegic refraction was repeated after 30 minutes of instilling Cyclogel eye drops (Alcon, 1 drop in each eye every 5

minute three times) using auto-refractometer. Children were classified according to errors of refraction as Emmetropia, Myopia (insignificant, low, moderate or high) and Hyperopia (insignificant, low, moderate or high). Chi square test was used to compare the observation of Bruckner test with the results of cycloplegic auto-refraction, and sensitivity and specificity of Bruckner test was calculated using ROC curve. P values less than 0.05 were considered as significant.

### Results

Total 102 children were included in our study, 56 (54.9%) males and 46 (45.1%) females with mean age of  $8.38 \pm 3.87$  years (range 1 - 16 years). Bruckner test was performed in all the children and found that 17(16.6%) right eyes as Emmetropic, 50(49.0%) as Hyperopic and 35(34.3%) right eyes as Myopic. 13(12.7%) left eyes were Emmetropic, 53(51.9%) were hyperopic and 36(35.2%) were myopic

**Table 2: Results of Bruckner and Cycloplegic Autorefraction**

	Right Eye			Left Eye		
	Bruckner	Pre. Autoref.	Post. Autoref.	Bruckner	Pre. Autoref.	Post. Autoref.
Emmetropia	17	27	24	13	24	25
Low Myopia	15	10	6	13	11	4
Mod. Myopia	10	13	14	11	14	15
High Myopia	10	12	10	12	12	8
Low Hyperopia	13	15	8	16	14	12
Mod. Hyperopia	23	17	27	17	19	20
High Hyperopia	14	8	13	20	8	18

Pre. Autoref. = Pre cycloplegic Autorefraction, Post. Autoref = Post cycloplegic Autorefraction

Pre-cycloplegic and post-cycloplegic auto-refraction was done in all the patients; Emmetropia was found in 24 and 25 right and left eyes respectively, significant hyperopia ranged from +1.0 to +12.25 D and found in 48 and 50 right and left eyes respectively, and significant Myopia ranged from -1.0 to -11.50 D and found in 30 and 27 right and left eyes respectively. (Table 2). Hyperopia was more common as compared to other refractive errors in children and was present in 44(43.1%) children, myopia was found in 36(35.2%)

**Table I: Pattern of Crescent during Bruckner Test with interpretation.**

Position of Crescent	Size of Crescent	Interpretation
No Crescent	--	Emmetropia
Inferior	Less than 10%	Insignificant Myopia (<1.0 D)
Inferior	10 to 20%	Low Myopia (1.0 - 2.0 D)
Inferior	20 to 50%	Moderate Myopia (2.0 - 5.0 D)
Inferior	More than 50%	High Myopia (> 5.0 D)
Superior	Less than 10%	Insignificant Hyperopia (<1.0 D)
Superior	10 to 20%	Low Hyperopia (1.0 - 2.0 D)
Superior	20 to 50%	Moderate Hyperopia (2.0 - 5.0 D)
Superior	More than 50%	High Hyperopia (>5.0 D)

children and Anisometropia in 7(6.8%) children. A p-value came to be < 0.001 which point out towards the effectiveness of Bruckner test in detecting refractive errors in children with accuracy (Table 3). The sensitivity and specificity of Bruckner test was calculated as 97% and 79% respectively.

**Table 3: Correlation of Bruckner with Post-cycloplegic Autorefraction**

Bruckner Test	Post Cycloplegic Autorefraction				Chi-Square Test (p-value)
	Emmetropia	Myopia	Hyperopia	Anisometropia	
Emmetropia	13	3	1	1	0.000
Myopia	1	33	0	1	
Hyperopia	1	0	39	2	
Anisometropia	0	0	4	3	
Total	15	36	44	7	

### Discussion

The analysis of data from current study suggests that the Bruckner test is very useful and highly accurate for rapid screening of refractive errors in children including myopia, hyperopia and anisometropia. <sup>9</sup> It is easy to perform. It needs a direct ophthalmoscope and it can be performed in less than 15 seconds. However, Bruckner test has certain limitations, as it is observer dependant; there are variations in observation by different observers. If the child is unable to follow the command to see a distant object, the size of pupil may be too small to comment on the presence and size of the crescent.

Present study found ametropia in 83.4% of children presenting to ophthalmology clinic which is much higher as compared to studies done earlier by Czepita D et al and Wen G et al. <sup>10,11</sup> The reason for this difference is that our study was clinic based while all studies done earlier were community based. As the prevalence of refractive errors in children is much higher and uncorrected refractive errors are one of the most important causes of visual impairment in the world, refractive errors in this age deserve special attention.

In the present study hyperopia was found as the commonest refractive error in children as compared to Myopia, and these findings are consistent with the results of study done previously by Ostadimoghaddam H but contrary to the findings of

Hashemi H et al who found Myopia as the most common refractive error in children. <sup>3,12</sup> The reason probably being the study was done in high school children. Early detection and treatment of refractive error is vital to achieve an optimal vision. The current recommendation from the American Association for Pediatric Ophthalmology and Strabismus for children is to undergo a comprehensive examination of the visual system in the preschool years to detect eye disorders<sup>13</sup>. Therefore, sensitive and specific screening tests must be in place at schools and in primary care physician's offices to aid in identification of children and encourage parents to seek ophthalmologic examination. The problem with early vision screening is that many children cannot identify the visual targets. The Bruckner reflex is the objective method that can be used to screen for refractive errors in this group of children.<sup>14,15</sup> Bruckner test is usually performed at a distance of 1 meter. The sensitivity of the Bruckner reflex improves by extension of the examination distance and distance of 4 meter was recommended though it is difficult to gain young children's attention at this distance. <sup>16</sup>

### Conclusion

The Bruckner test appears to have potential as a screening test to detect refractive errors. Analysis with the pre and post cycloplegic auto refraction indicates definite usefulness and reasonable accuracy of the Bruckner test for detecting myopia, hyperopia and anisometropia in children.

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