

# Refractive Errors and Other Eye Diseases in Primary School Children in Petaling Jaya, Malaysia

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**Aim:** To determine the prevalence of refractive errors and other eye diseases in primary school children in Petaling Jaya, Malaysia.

**Patients and Methods:** A total of 1214 primary school children, aged from 7 to 12 years, were examined for refractive errors, colour vision defects, and other eye diseases. Visual acuity, anterior segment examination, colour vision test, and fundus examination were performed.

**Results:** One or more ocular abnormalities were found in 499 children (41.1%); refractive errors in 33.3%, colour vision defects in 2.6%, squint in 2.5%, epicanthus tarsalis in 1.6%, ocular melanosis in 3.8%, ptosis in 1.1%, trichiasis in 0.2%, chalazion in 0.2%, allergic conjunctivitis in 0.2%, conjunctival naevus, capillary haemangioma of the face in 0.1%, squamous papilloma of lower lid in 0.1%, and unilateral optic atrophy in 0.1%.

**Conclusions:** Myopia is the most common refractive error in primary school children. Examination of primary school children at the time of their admission by an ophthalmologist will help in early detection of refractive errors and other eye diseases so that they can be treated and visual impairment can be minimised.

**Key words:** Blepharoptosis, Child, Color vision defects, Refractive errors, Strabismus

*Asian J Ophthalmol.* 2006;8:195-8

## Introduction

Eyes are the windows of learning and visual appreciation of objects contributes to learning in any individual's life. Visual disability in childhood can be minimised, or even prevented, if the causes are detected early and treated before they become irreversible. Refractive errors are one of the major causes of low vision and preventable blindness, and the most common reason for patients to consult ophthalmologists and optometrists throughout the world. Detection of visual impairment in school children is important. Poor vision in childhood affects performance in school, and has a significant impact on the future life of the child in terms of education and development. Correction of refractive errors will minimise visual disabilities and improve the child's life in general.

Several studies on the screening of school children for eye diseases such as refractive errors, strabismus, colour blindness, cataract, vitamin A deficiency, trachoma, sty, blepharitis, and

chalazion are available.<sup>1-13</sup> Teoh and Yow from Malaysia have reported that 7.1% of children had refractive errors and 2.2% had squint.<sup>13</sup> However, these authors did not mention the type and severity of refractive errors, or the presence of any other eye diseases. Since there is a paucity of data on the prevalence of eye diseases in primary school children from Malaysia, this study was undertaken to determine the prevalence of refractive errors, colour blindness, and other eye diseases among children studying in a national primary school.

## Patients and Methods

### Patients

All children attending Sri Petaling National Primary School, Petaling Jaya, Selangor, Malaysia, were included in this study. The children were examined at the school between September 2001 and November 2002. The study was approved by the ethics committee of the Faculty of Medicine, University of Malaya, Kuala Lumpur, Malaysia.

### Methods

After taking an ocular history, the visual acuity was tested using the Snellen chart. The pinhole test was done whenever necessary.

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Students wearing spectacles were tested for visual acuity with and without their glasses. The power of the lenses was measured using a Zeiss SBM 70 Focimeter (Carl Zeiss, Jena, Germany). Colour vision was tested using Ishihara Pseudoisochromatic colour plates (Kanehara Co Ltd, Tokyo, Japan). Each student was asked to read the numbers on the charts at normal reading distance, and the results were interpreted as per the instructions supplied by the manufacturer. Detailed examination of the eyelids, conjunctiva, sclera, cornea, anterior chamber, iris, pupil, and lens was carried out using torchlight and a magnifying loupe (Eagle +1.75X; Eagle Vision, Memphis, USA). Later, the Hirschberg (corneal light reflex) test was done to detect any squint. The cover test was done to find out whether the squint was in one eye only or alternating in both eyes. Ocular movements were tested in all the cardinal positions to check for paralysis of the extraocular muscles. Fundus examination was done in the same room (with the lights off) with direct ophthalmoscope. If there was any abnormal fundus finding, eyes were dilated with tropicamide 1% eye drops and the fundus was re-examined.

Children with vision <6/6 and other ocular abnormalities were referred to the eye clinic at the University of Malaya Medical Center for cycloplegic refraction, further evaluation, and treatment. The child and parents were informed about the action of the eye drops instilled in the eyes for refraction, and consent was given. Homatropine 2% eye drops, one drop in each eye at 15-minute intervals, were instilled 3 times. The refraction was done with the streak retinoscope, 1 hour after the first drop of homatropine was placed in the eyes. To constrict the pupil, pilocarpine 2% eye drops, 1 drop in each eye, was administered at the end of the refraction test. Three days later, subjective correction was done and glasses were prescribed when needed.

A child with defective vision ( $\leq 6/9$ ) who improved to 6/6 clear vision with -0.25 or +0.25 D or more power lens correction was considered to have refractive error. Even though the power is minimal, glasses are prescribed for these children to have clear vision. Visual acuity of  $\leq 6/12$  in one or both eyes with best correction glasses was taken as amblyopia, in accordance with other reported studies.<sup>8-10</sup>

Students who did not come for an eye examination were reminded by sending a letter, signed by headmaster and research project investigator, twice to their home address. Those who did not attend for an eye examination despite the second letter were designated as defaulters.

## Statistical Analysis

The findings were recorded on a data sheet, and analysed by using the Statistical Product and Service Solution (SPSS) programme.

Pearson correlation coefficient was used to analyse the significance of the relationship between refractive error and the age of the children. A p value of  $\leq 0.05$  was considered to be significant.

## Results

1214 of 1310 students from years 1 to 6 at Sri Petaling National Primary School were examined for a response rate of 92.67%. There were 661 boys (54.4%) and 553 girls (45.6%). The children were aged between 7 and 12 years (children start school at the age of 7 years in Malaysia). There were 714 Malays (58.8%), 308 Chinese (25.4%), and 192 Indians (15.8%).

One or more ocular abnormalities were found in 499 students (41.1%). Uncorrected visual acuity (UCVA) 6/6 was noted in 810 students, and UCVA  $\leq 6/9$  was noted in 1 eye in 52 students and in both eyes in 352 students. These 404 students were diagnosed to have refractive error since there was no other eye disease to account for their diminished vision. Thus, 33.3% of students had refractive errors. At the time of the study, 149 of the 404 students with refractive errors (36.9%) were wearing glasses. Of 404 students with refractive errors, 201 were Malays (49.7%), 125 were Chinese (30.9%), and 78 were Indians (19.3%); 199 were boys (49.2%) and 205 were girls (50.7%). Forty two children did not attend for refraction, so refraction was done for 362 students. The likely reasons for default were that the parents felt that nothing was wrong with their child's vision or that the parents were too busy to bring their child for an eye check.

The types of refractive errors are shown in Table 1. Myopia (myopia + myopic astigmatism) was noted in 321 children, hypermetropia (hypermetropia + hypermetropic astigmatism) in 16 children, and mixed astigmatism in 25 children. 138 children had astigmatism (myopic astigmatism, hypermetropic astigmatism, or mixed astigmatism). Among the 25 children with mixed astigmatism, 4 had myopic sphere with hypermetropic cylinder and 21 had hypermetropic sphere with myopic cylinder.

The prevalence of myopia was highest in children aged 10 years (49 of 72 children; 68.1%), which was statistically significant

**Table 1. Refractive errors in primary school children according to age (n = 362).**

Refractive error	Age (years)						Total
	7	8	9	10	11	12	
Myopia	14	31	29	49	37	53	213
Simple myopic astigmatism	3	—	—	—	—	—	3
Compound myopic astigmatism	6	15	13	18	26	27	105
Hypermetropia	2	1	1	2	3	2	11
Simple hypermetropic astigmatism	—	—	—	—	—	—	—
Compound hypermetropic astigmatism	1	1	1	—	2	—	5
Mixed astigmatism	8	6	3	3	5	—	25
Total	34	54	47	72	73	82	362

**Table 2. Severity of refractive errors in primary school children (n = 362).**

Spherical equivalent (D)	Right eye	Left eye
Mild myopia (-0.25 to -1.75)	210	224
Moderate myopia (-2.00 to -5.00)	86	84
Severe myopia (>-5.00)	18	16
Mild hypermetropia (+0.25 to +1.75)	18	18
Moderate hypermetropia (+2.00 to +5.00)	3	1
Severe hypermetropia (>+5.00)	—	—
Zero spherical equivalent	27	19
Total	362	362

( $p = 0.01$ ). Myopia (excluding the children with astigmatism) was seen in 213 children (17.5%), hypermetropia (excluding the children with astigmatism) was seen in 11 children (0.9%), and astigmatism (both myopic and hypermetropic) was seen in 138 children (11.4%).

The majority of children with myopia had mild myopia in either eye (Table 2). Even though the myopia was mild, glasses were prescribed for improvement of vision to 6/6 in these eyes.

Amblyopia was noted in 56 children (4.6%). Amblyopia was noted in one eye in 26 students (2.1%), and in both eyes in 30 students (2.5%); 51 children with amblyopia had refractive error (49 myopia and 2 mixed astigmatism) and 5 had squint (3 convergent squint and 2 divergent squint).

In addition to refractive errors, other ocular abnormalities were found (Table 3). In some children, more than one ocular abnormality was noted in one or both eyes. Ocular melanosis (melanosis of sclera present since birth) was the most common eye disease observed in this study, affecting 3.78% of children. Colour vision defects were seen in 32 children (2.63%), predominantly occurring in boys (31); 1 girl had red-green deficiency. Defective distant vision in one or both eyes was noted in 13 children (10 of 27 children with red-green deficiency and 3 of 5 children with total colour blindness). The visual acuity was 6/9 to 6/18 in 9 children, 6/24 to 6/60 in 3 children, and  $\leq 6/60$  in 1 child. Six of the 13 children wore glasses with good improvement of vision (6/6 to 6/9 in both eyes). The remaining 19 children had 6/6 vision in both eyes,

**Table 3. Other eye diseases in primary school children (n = 1214).**

Disease	Number of children (%)
Epicanthus tarsalis	19 (1.56)
Congenital ptosis	13 (1.07)
Trichiasis	3 (0.24)
Chalazion	2 (0.16)
Papilloma	2 (0.16)
Capillary haemangioma of eyelids	1 (0.08)
Allergic conjunctivitis	2 (0.16)
Conjunctival naevus	1 (0.08)
Ocular melanosis	46 (3.78)
Primary optic atrophy	1 (0.08)
Divergent squint	27 (2.22)
Convergent squint	3 (0.24)
Total colour blindness	5 (0.41)
Red-green deficiency	27 (2.22)

suggesting that the majority of children with colour vision defects have good distance vision. None of these children had any positive family history of colour blindness. All the children and their parents were counselled in choosing a future career, which excluded jobs dealing with colour discrimination such as armed forces service, railways, telecommunication, textile industry, and computer graphic applications.

## Discussion

The prevalence of ocular morbidity (one or more ocular abnormalities) was found in 41.1% of children in this study; this is higher than the rates of 9.4%,<sup>2</sup> 11.0%,<sup>12</sup> 13.0%,<sup>5</sup> and 24.4%<sup>4</sup> found in other studies. The prevalence of refractive errors (33.3%) in this study is much higher than that in other studies reported from different countries (Table 4). The higher prevalence of ocular morbidity seen in the present study could be due to the higher prevalence of refractive errors when compared with other studies. The prevalence of myopia was observed to be highest in 10-year-old children (68.1%) in this study, which was statistically significant. A similar finding was noted in a Hong Kong study, with the highest incidence of myopia occurring in 11-year-old children amongst a study group aged 7 to 11 years.<sup>14</sup> The prevalence of amblyopia due to refractive errors in this study was 4.2% (51 of 1214 children). This was less than the previously reported figures of 5.0% from China,<sup>8</sup> 9.0% from Nepal,<sup>9</sup> and 6.5% from Chile.<sup>10</sup> The prevalence of colour vision defects of 2.63% in this study is similar to that of 1.7% reported by Reddy<sup>4</sup> and 1.6% reported by Cummings.<sup>6</sup>

The prevalence of 2.5% for squint in this study is higher than the figures reported by Reddy<sup>4</sup> and Wedner et al,<sup>11</sup> but is similar to that reported by Turacli et al,<sup>5</sup> Pokharel et al,<sup>9</sup> and Teoh and Yow,<sup>13</sup> and lower than that reported by Laatikainen and Erkkila,<sup>1</sup> Simpson et al,<sup>2</sup> Chaturvedi and Aggarwal,<sup>7</sup> and Maul et al<sup>10</sup> (Table 5).

**Table 4. Prevalence of refractive errors in school children from different countries.**

Study	Country	Number of children	Age group (years)	Percent with refractive errors
Laatikainen and Erkkila <sup>1</sup>	Finland	411	7-15	17.5
Simpson et al <sup>2</sup>	New Zealand	984	7	10.5
Jensen and Goldschmidt <sup>3</sup>	Denmark	1216	5-13	11.8
Reddy <sup>4</sup>	India	3675	11-15	17.5
Turacli et al <sup>5</sup>	Turkey	23,810	5-12	11.0
Cummings <sup>6</sup>	UK	1809	8-10	31.0
Chaturvedi and Aggarwal <sup>7</sup>	India	679	5-15	7.4
Zhao et al <sup>8</sup>	China	5884	5-15	12.8
Pokharel et al <sup>9</sup>	Nepal	5067	5-15	2.9
Maul et al <sup>10</sup>	Chile	5303	5-15	15.8
Wedner et al <sup>11</sup>	Tanzania	1386	7-19	1.0
Nepal et al <sup>12</sup>	Nepal	1100	5-16	8.1
Teoh and Yow <sup>13</sup>	Malaysia	650	7	7.1
Present study	Malaysia	1214	7-12	33.3

**Table 5. Prevalence of squint in school children from different countries.**

Study	Country	Number of children	Percent with squint
Laatikainen and Erkkila <sup>1</sup>	Finland	411	4.6
Simpson et al <sup>2</sup>	New Zealand	988	3.9
Reddy <sup>4</sup>	India	3675	0.3
Turacli et al <sup>5</sup>	Turkey	23,810	2.5
Chaturvedi and Aggarwal <sup>7</sup>	India	679	7.4
Pokharel et al <sup>9</sup>	Nepal	5067	2.1
Maul et al <sup>10</sup>	Chile	5303	9.9
Wedner et al <sup>11</sup>	Tanzania	1386	0.5
Teoh and Yow <sup>13</sup>	Malaysia	650	2.2
Present study	Malaysia	1214	2.5

Vitamin A deficiency has been reported in 3.7% of children from India,<sup>4</sup> and in 0.4% of children from Nepal.<sup>12</sup> However, there were no children with signs of vitamin A deficiency affecting the eyes in this study. This could be due to the good nutritional status of children in Malaysia.

It is ideal to screen preschool children to correct refractive errors at an early age, but this may not be practical at a national level. Therefore, to reduce the cost and encourage participation in the programme, inclusion of vision screening and an eye health check as part of the school health care services is recommended. This can be organised by medical officers working in the Ministry of Health to take place immediately after admission of children into primary school. All children with defective vision and other eye problems should be referred to the nearest ophthalmologist for further assessment and management. It is important to provide health education about common eye diseases to the general public, school teachers, and primary health care workers so that they can detect the eye problems of children and seek advice from ophthalmologists. Refractive errors can be detected early and corrected so that vision can be improved and amblyopia can be reduced. At the same time, eye diseases such as ptosis, squint, and cataract can be detected and treated to prevent ocular morbidity in children.

## Acknowledgements

The authors are grateful to The University of Malaya for funding this project by the short-term research grant (Vote F 0126/2001D); the Director of Education, Selangor State, Malaysia for giving permission to examine the school children; and the Headmaster and teachers of Sri Petaling National Primary School who helped in conducting this study.

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