Prevalence of Visual Impairment in Pre-Primary School Children in a Central Indian District

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ABSTRACT

BACKGROUND
Uncorrected Refractive Errors (REs) are a major cause of visual impairment in children resulting in poor academic performance and increased school dropouts. Children with refractive errors, even if small, suffer from visual strain and consequently perform poorly at school. There are only a few studies carried out in India in this age group. The purpose of this study is to provide a framework for assessment and correction of ocular morbidity in pre-school children. We wanted to assess the magnitude of the problem of refractive errors and other ocular morbidity in pre-primary school children in the age group of 4 - 7 years.

METHODS
This is a descriptive cross-sectional study conducted at one of Central India's industrial towns among 2000 children attending pre-primary school in the age group of 4 - 7 years. Children were screened by ophthalmologists. The examination included visual acuity measurements, ocular motility evaluation, cover uncover test and colour vision test. Children with defective vision were subjected to dilated retinoscopy and fundus examination. The pattern and distribution of visual acuity, its impairment, and any accompanying ocular morbidity were studied. Refractive errors such as myopia, hypermetropia and astigmatism were defined as correction equivalent to or more than - 0.5 diopter (- 0.5 D), + 0.5 D and ± 0.5D respectively in children with reduced visual acuity. Amblyopia was defined as non-improvement or reduced visual acuity (< 6 / 9) with optical correction without any organic cause. Statistical analysis was done using percentage analysis using Epi Info software version 7.

RESULTS
A total of 2000 children from kindergarten were examined out of which 1126 were male and 874 were females. Refractive error was found in 146 students. Hypermetropia was found in 70, myopia in 50 and 12 had amblyopia. Apart from refractive errors, other ocular morbidities found in our study included colour vision defect (1 %), squint (0.5 %), eyelid diseases like blepharitis, sty, conjunctival diseases like allergic conjunctivitis and traumatic mydriasis of the iris.

CONCLUSIONS
Ocular morbidities noted included refractive errors (7.3 %), colour vision defects, squint, eyelid diseases and allergic conjunctivitis. Many of these are causes of correctable blindness and remedial measures taken on time will go a long way to reduce the burden of disease.

KEYWORDS
Visual Impairment, Pre-Primary Children, Refractive Errors, Hypermetropia, Amblyopia, Astigmatism
**BACKGROUND**

Good vision is a prerequisite for early learning. As, a major part of learning in early age group is through, playing with peers and observing and exploring the surrounding environment, if visual impairment is not identified and addressed correctly at this age, it leads to learning difficulty and psychosocial inadequacies.\(^1\) Young children do not complain, but try to adapt themselves early in life. Hence behavioural changes are observed in these children such as holding object(s) nearer to their eyes, abnormal head postures, reluctance for visually demanding work, or disinterest in outdoor activities.\(^5\) Refractive error is the commonest cause of avoidable blindness in school going children in India.\(^6\) Undetected and untreated refractive errors, eye diseases and strabismus in early age can lead to amblyopia.\(^8\) The total burden of the disease has still not been identified in many parts of India though various studies have shown a rural and urban prevalence of 2 - 3 \% and 5.1 \% respectively in school going children of 5 - 15 years.\(^9\,10,11,12\)

In India children in 4 - 7 years of age can be easily identified in kindergarten schools and in childcare centres ‘Anganwadi’s’ run under the ICDS (Integrated Child Development Scheme) programme of central and respective state governments in semi-urban and rural areas. Teachers and care givers in these centres can play an active role in identification of children with any visual impairment. Therefore, it is important to sensitize them about the immediate as well as long term impact of visual impairment.

**METHODS**

2000 children aged 4 - 7 years from different kindergartens and childcare centres (anganwadis) in Central India were examined. The study had the approval of Institutional Ethical Board and follows the guidelines of the Declaration of Helsinki. Permission was obtained from schools and parents for the conduct of the survey. Brief records were kept of the visual hygiene such as lighting condition, seating arrangement, plus or minus desks and types of black-board surfaces. Complaints about vision and / or abnormal posture of any child in the classroom were inquired about with the class teacher. The same, as identified and reported by them along with history of any significance including ocular trauma were noted.

General examination of the child was done to find out any systemic disease affecting the eyes. Face asymmetry and position of head was noted for any abnormal head posture due to extraocular muscle paresis or paralysis. The acuity of distant central vision was recorded for both eyes separately with the Snellen’s 4-meter test-chart. The chart was positioned such that there was sufficient diffuse daylight, or adequate artificial light arrangements were made. Colour vision was tested by using Ishihara’s colour vision chart in diffuse day light.

Eyebrows were examined for any significant loss of lashes. Lid position was examined in relation to its position on cornea. Lid was also examined for any thickening, entropion, ectropion, trichiasis & distichiasis. Hirschberg’s test was done to find out any deviation of eyes. Conjunctival sac was examined for any congestion, pigmentedations, symblepharon, nodules, follicles & foreign body. Diagnosis of trachoma was made only by clinical examination i.e., thickening of lid, scarring of palpebral conjunctiva, typical distribution of follicles, Herbert’s pit, pannus & its sequelae.

Cornea was examined for size, shape, curvature, transparency & sensitivity. Sclera was examined for presence of any nodule suggesting of episcleritis or scleritis. Any pigmentation & staphylocoma was noted. Pupil was examined for its size, shape, position, its reaction to light both direct & consensual.

Lens was seen for its transparency & position. All these eye examinations were conducted with a hand torch. Students found to have any abnormality were referred to the ophthalmology department along with their parents for further evaluation. This was done by giving referral slips to the students. Children who presented at the hospital underwent complete ocular examination, cycloplegic refraction and glasses were prescribed. Amblyopia and its consequences and need for frequent examination were explained to the parents.

All details were entered in a pre-designed proforma. Ametropia was defined as uncorrected distant visual acuity of less than 6 / 12 which improved with pinhole by at least two lines on the Snellen chart. In children with reduced visual acuity, refractive errors of myopia, hypermetropia and astigmatism were defined respectively as correction equivalent to or more than - 0.5 diopter (D), + 0.5D, and ± 0.5D. Amblyopia was defined as non-improvement of reduced visual acuity (< 6 / 9) even with optical correction without any organic cause.

**RESULTS**

The following study was conducted among 2000 pre-primary children. The study group constituted of children between four to seven years of age.

The distribution of visual acuity among the two thousand children is such that 472 eyes had visual acuity less than 6 / 6. Out of these, 256 eyes had visual acuity of 6 / 9. The rest of the visual acuity grading may be considered defective vision i.e. 216 eyes had visual acuity 6 / 12 or less. This is due to impaired vision in 146 children [Inset figure 1]. The number of children in the 4 - 5 years age group was 214 out of which 18 (8.4 \%) students had visual defects. The number of children in the age group of 5 - 6 years was 1210, out of which 82 had visual defects [Table 1].

Total number of children examined was 2000. The number of boys was 1126 out of which 94 (8.3 \%) have visual defects less than / equal to 6 / 12. The number of girls examined was 874 out of which 52 (5.9 \%) had visual defect less than / equal to 6 / 12 [Table 2].

In the study, children with vision less than 6 / 12 were considered as having visual deficits. All the children with refractive error were called for refraction. Refraction was done under cycloplegia. 70 children turned out to be...
hypermetropes while the number of myopes was 50 (2.5%). Amblyopia defined as non-improvement of reduced visual acuity (< 6 / 9) which was seen in 12 (0.6 %) children. [Table 3]. Two children did not come for follow up. Hypermetropic anisometropia was found in 8 children. 8 children with complaints of headache were also given correction though their uncorrected vision was better than 6 / 12.

Colour vision was tested by Ishihara’s isochromatic chart in all children. The number of children with colour vision defects was found to be 20 (1.0 %). Colour vision defects were found only in boys (Table 4).

Apart from visual acuity and colour vision, an overall assessment of ocular morbidity was also done. The number of children suffering from lid diseases such as blepharitis, trichiasis was 14 (0.7 %). The number of children suffering from corneal diseases was 4 (0.2 %), 10 (0.5 %) children were found to have squint. Two children had traumatic mydriasis in one eye each. Other defects that came to notice included one black eye due to trauma, conjunctival congestion due to foreign body in four eyes, iris nevus in four eyes, and albinism in six students. Thus it was found that out of the 2000 children, 70 (3.5 %) students were suffering from eye diseases, including 10 who had squint.

**TABLE 1. Age Wise Prevalence of Refractive Errors**

| Age (in Years) | No. of Children | No. of Children with Visual Defects (%) |
|----------------|-----------------|----------------------------------------|
| 4 - 5          | 214             | 18                                     |
| 5 - 6          | 1210            | 82                                     |
| 6 - 7          | 576             | 46                                     |

**DISCUSSION**

According to WHO, “visual impairment is defined as uncorrected visual acuity less than 6 / 12 (20 / 40) in the better eye”.13 WHO estimates that “approximately 45.5 million people are impaired globally due to uncorrected refractive errors.”13,14,15

Why and how pre-school children? Children in the age group 0 - 6 years constitute around 13.12 % of the population of India (2011 census). To cater to the needs of these children, Government of India runs ‘The Integrated Child Development Services (ICDS) scheme’. Childcare centres known as ‘Anganwadi’ are part of this programme.16 Number of beneficiaries in the age group of 3 - 6 years for pre-school education were 365.44 lakh in March 2015.16 Early screening can start from these centres which are distributed throughout the urban and rural India.

Uncorrected refractive error and strabismus are a known cause for development of amblyopia.17-19 Early screening is essential to detect and treat these conditions. Cost effectiveness of screening in this age group has been a subject of controversy.20,21 Inspite of this the need for vision screening at this age has been established beyond doubt.22-24

Very few studies have been conducted in India in this age group. The prevalence of refractive error emerging out of the present study is 7.3 %. Rewri et al from Udaipur (Western India) reported a prevalence of 8 %. A meta-analysis from different parts of world have reported a prevalence rate ranging from 1.8 - 23 %.25,29 Among all these study reports, the common conclusion is the prevalence of hyperopia in early years, and myopia later on. In this study also hyperopia is found to be predominant. The presence of amblyopia is 0.6, which is lower than that reported in other studies.25 Sheela Devi et al, in their review of prevalence of refractive error in children less than 15 years of age in India, reported an overall prevalence of 8 % in general population and 10.8 % in school going children. The distribution of types of refractive errors among the latter is stated as myopia, hyperopia and astigmatism as 5.3 %, 4.0 % and 5.4 % respectively.30

Amblyopia due to anisometric hypermetropia was seen in 8 out of 12 students diagnosed with amblyopia. Other ocular disease such as blepharitis, ptosis, chalazion, stye, allergic conjunctivitis, xerosis and Bitot’s spot were also seen. Vitamin A drops were given free of cost at the hospital’s vaccination centre to students who had conjunctival xerosis and Bitot’s spots.

The drawback of our study was the smaller sample size and need to follow-up these children till their vision stabilized.
CONCLUSIONS

One of the interesting facets of this survey was the awareness among teachers and caregivers about children’s visual needs, whereas many parents were unaware of their child’s visual discomfort. Parents as well as children were reluctant to use glasses at this age. Our study was done to highlight the magnitude of the problem of visual impairment prevalent among younger children, and the need for early intervention, so as to enable them to achieve their full potential.

This survey not only highlighted the types of eye diseases prevalent in the pre-school children, but has also given enough indications that health education is also needed, wherein the participation of students, parents and teacher is desirable.

Data sharing statement provided by the authors is available with the full text of this article at jebmh.com.

Financial or other competing interests: None.

Disclosure forms provided by the authors are available with the full text of this article at jebmh.com.

Authors thank all children and caregivers for their participation and support. Authors also thank all support staff of ophthalmology department for helping in retinoscopy and refraction.

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