

# Reduced Vision and Refractive Errors, Results from a School Vision Screening Program in Kanchanpur district of Far Western Nepal

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## ABSTRACT

### Background

At present there is no data available on reduced vision and refractive errors in school children of far western Nepal. So, school screening records were used to obtain data useful for planning of refractive services.

### Methods

Data are provided from school screening conducted by Geta Eye Hospital during February/March 2008. The cases with complete data sets on visual acuity, refractive error and age were included and analyzed using computer software.

### Results

Of 1165 children (mean age 11.6±2.5 years) examined, 98.8% (n= 1151) had uncorrected visual acuity of 6/9 and better in at least one eye whereas 1.2% (n= 14) had acuity 6/12 and worse in both eyes. Among them, either eye of 9 children improved to 6/9 and better with correction. However, visual acuity was 6/12 and worse in both eyes of 5 children even after correction. There were 24 children with refractive errors (myopia, 1.54%; n= 18 and hypermetropia, 0.51%; n=6) in at least one eye. The spherical equivalent refraction was not significantly different with age and gender.

### Conclusions

The incidence of reduced vision and refractive errors among school children of this semi rural district were low.

### Key Words

*reduced vision, refractive error, school children, school screening*

## INTRODUCTION

School vision screening is conducted in Nepal by Nepal Netra Jyoti Sangh through various Eye Hospitals to identify children with vision problems and offer them the corrective measures.<sup>9,10</sup> After eye examination these children were provided corrective glasses at no cost. Generally children are not aware about their vision problems, especially if the problem exists since early childhood or the vision is reduced in one eye only. Even when they are aware, they might not report. This way vision problem among children can go undetected. Thus screening programs are helpful in identifying children with reduced vision. Reduced vision due to refractive error is a serious problem among school age children and if not corrected in time can limit their classroom performance and economic prospect in later life.<sup>12</sup> The largest proportion of reduced vision due to refractive errors worldwide has been reported from urban areas in south-east Asia and China.<sup>12</sup> However, all countries in south Asia and China do not share similar prevalence of reduced vision and refractive errors.<sup>3,5,11,12,18</sup> In a series of studies called Refractive error study in children (RESC) large proportion of children with reduced vision (6/18 or worse) were due to refractive errors were reported from China (94.9%)<sup>5</sup> followed by India (61%)<sup>3</sup> and Nepal (56%).<sup>11</sup>

Studies reported myopia prevalence of 1.2% in Nepal,<sup>11</sup> 4.1% in India<sup>3</sup> and 14.9% in China.<sup>18</sup> Within Nepal, studies among school children from Kathmandu reported higher prevalence of refractive errors, 8.1% (myopia= 4.3%; astigmatism= 2.5% and hypermetropia= 1.3%),<sup>8</sup> 18.6%<sup>14</sup> and 21.8%<sup>16</sup> compared to those from outside Kathmandu.<sup>4,11</sup> We assumed low prevalence of refractive errors among school children in Kanchanpur. The low prevalence was assumed in view of the rural location of Kanchanpur district.

The aim of this study was to elucidate the incidence of reduced vision and refractive errors among school children from Kanchanpur district of Far Western Nepal according to their types and relationship with age and gender.

## METHODS

This is a retrospective descriptive study on reduced vision and refractive errors among school children from Kanchanpur district of Far western Nepal. The data were collected by a mobile team of Geta Eye Hospital within school premises during its regular school vision screening.

Of 4000 school children screened during February/march 2008, only 1165 had complete set of data on visual acuity, refraction, age and gender were thus included in this study. Other records that lacked information on visual acuity,

refraction and age were not included in the study. The children enrolled in grade 1 to 10 from 3 schools were included in the study.

The public schools accessible by roads were selected for the screening. The screening program was conducted in collaboration with education and public health offices in the district. Screening team consisted of an optometrist and an assistant. The tests included measurement of visual acuity, anterior segment evaluation, non cycloplegic refraction and direct ophthalmoscopy. An assistant assessed visual acuity with a Snellens' vision chart at 6 meter distance using daylight from 10 am to 4 pm. Acuity was tested for each eye separately. An optometrist performed all other tests. Anterior segment was assessed by a focusable torch. Retinoscopy was performed among all children at 50 centimeters with children's eyes fixated on vision chart at 6 meters. A retinoscopic reflex was quickly swiped across pupillary area with streak retinoscope (Heine, Germany). Subjective refraction with trial frame was performed only if retinoscopy suggested refractive errors, and/or visual acuity was less than 6/6. Ophthalmoscopy was performed in cases suspected of posterior segment abnormalities. Glasses were prescribed and provided by an optometrist to those who needed. Children with prescription of 0.5 Diopters spherical equivalent refraction and more in either eye were prescribed glasses. Antibiotic eye drops and/or ointments were provided when infections were observed, like conjunctivitis. Children with all other pathological conditions were referred to Geta Eye Hospital for further evaluation. Registration of all children was done with the help of class teachers and student volunteers. Institutional permission was obtained for the use of the data for the study.

The data were analyzed using SPSS (17.0) computer software. Data were presented in the form of tables. The eyes with uncorrected visual acuity 6/12 and worse were categorized as having reduced vision. Myopia and hypermetropia were diagnosed for eyes with prescription of 0.5 D spherical equivalent and more. The Spherical equivalent refraction (SER) was calculated by dividing the cylindrical prescription by 2 and adding it to the spherical prescription. Any eye with  $\pm 0.75$  cylinder Diopter and more was considered to have astigmatism. A child was myopic if one or both eyes had myopia; hyperopic, if one or both eyes had hyperopia, provided there was no myopia in the other eye and emmetropic if both eyes had emmetropia. Similarly, a child with astigmatism in one or both eyes was considered to have astigmatism.

## RESULTS

Among 1165 records analyzed, there were 43.9% boys

and 56.1% girls. The participant included ranged from 5 to 19 years of age with lowest number of participants were in 5 and 19 (n=1) year age group and highest number in 12 (n=170) year age group. The largest proportion of children, 13.2% (n=154) were in grade 7 and smallest proportion 0.77% (n=9) in grade 10. In other grades fairly even distribution of children ranging from 63 to 154 were found. The largest caste/ethnic group was Chhetri (27.1%), followed by Dalit (25%), Brahmin (23.2%) and Tharu (12.5%).

### VISUAL ACUITY

Altogether 2330 eyes of 1165 children (mean age 11.6±2.5 years) were evaluated. Uncorrected visual acuity was 6/9 and better in at least one eye of 98.8% (n=1151) children (table 1). The uncorrected visual acuity in right eyes ranged from 6/6 to 3/60 and in left eyes it ranged from 6/6 to 5/60. With correction, 99.57% (n=1160) children obtained visual acuity of 6/9 and better in at least one eye and none of the children had worse than 6/60 in both eyes. Uncorrected visual acuity 6/12 and worse were present in both eyes of 1.2% (n=14) and one eye of 8 children. Altogether 22 children aged 10 to 16 years had uncorrected visual acuity 6/12 and worse (reduced vision) in at least one eye. Among them, visual acuity improved to 6/9

or better in at least one eye of 64.28% (n=9) children. However, visual acuity did not improve to 6/9 or better in both eyes of 0.42% (n=5) children. A significant correlation between uncorrected visual acuity in right and left eyes (r=0.68; p<0.0001) was observed.

**Table 1.** Distribution of uncorrected and corrected visual acuity

|           | Visual acuity  | Uncorrected visual acuity, No. (%) | Corrected visual acuity, No. (%) |
|-----------|----------------|------------------------------------|----------------------------------|
| Both eyes | ≥6/9           | 1143 (98.1)                        | 1153 (98.96)                     |
|           | <6/9           | 8 (0.68)                           | 7 (0.6)                          |
| One eye   | ≥6/12 to ≤6/18 | 6 (0.51)                           | 4 (0.34)                         |
|           | ≥6/24 to ≤6/60 | 7 (0.6)                            | 1 (0.08)                         |
|           | <6/60          | 1 (0.08)                           | 0 (0.00)                         |
| Total     |                | 1165 (100)                         | 1165 (100)                       |

### REFRACTIVE ERRORS

Refractive errors were present in at least one eye of 2.06% (n=24) and both eyes of 1.45% (n=17) children. Myopia was present in 1.54% (n=18) and hypermetropia in 0.51% (n=6) children (table 2). The spherical equivalent refraction (SER) for both eyes was within -4.0 to +4.5 Diopters. Of the eyes with refractive errors, 63.6% (n=28)

were within ±2.0D. A significant correlation was found between spherical equivalent refraction in right and left eyes (r=0.90; p<0.0001). Astigmatism was present in either eye of 0.6% (n=7) children.

**Table 2.** Distribution of refractive errors

| Eye       | Refractive status | Children No. (%) |
|-----------|-------------------|------------------|
| Both eyes | Emmetropia        | 1141 (97.9)      |
| One eye   | Myopia            | 2 (0.17)         |
| Both eyes | Myopia            | 16 (1.37)        |
| One eye   | Hypermetropia     | 5 (0.43)         |
| Both eyes | Hypermetropia     | 1 (0.08)         |
| Total     |                   | 1165 (100)       |

### EFFECT OF AGE AND GENDER

Refractive errors were present among children between 7 to 16 years with the largest proportion, among 15 year olds. Six out of 89, 15 year old children had refractive errors (myopia=5; hyperopia=1). Children from 7 to 15 years were only taken for the association test. The age was not associated significantly with spherical equivalent refraction in right (X<sup>2</sup>, p=0.53) and left eyes (X<sup>2</sup>, p=0.11). Gender was also not associated significantly with SER in right (X<sup>2</sup>, p=0.41) and left eyes (X<sup>2</sup>, p=0.44).

### DISCUSSION

#### Visual acuity

The majority of school children had normal/near normal uncorrected visual acuity. The proportion of uncorrected reduced vision was slightly lower than that reported in eastern Nepal (2.9%).<sup>11</sup> In eastern Nepal 138 out of 4803 children had visual acuity 6/12 and worse in either eye. Contrary to these reports, larger proportions of children with uncorrected reduced vision were reported from Kathmandu.<sup>8,14,16</sup> The incidence of corrected reduced vision in this study was similar to that reported from Kathmandu<sup>8,14,16</sup> and eastern Nepal.<sup>11</sup> In eastern Nepal 65 out of 4803 children had reduced vision even after correction. The reduced vision even after correction must be due to causes other than refractive errors.

#### Refractive errors

Refractive errors among school children in this south western district of Nepal were low and comparable to that reported from eastern Nepal (2.6%).<sup>11</sup> In this study, majority of the eyes with refractive errors were myopic whereas majority of the eyes were hyperopic in the study from eastern Nepal.<sup>11</sup> The reason for not finding many children with hyperopia might be under detection of hyperopia in this study as full refraction was performed

only in eyes with below normal acuity. Another reason might be that cycloplegic refraction was not performed. The prevalence of myopia has been reported to vary between public and private school children.<sup>4,8,14</sup> Lower educational pressure among public school children and rigorous schooling among private school children have been discussed as the reason for the observed differences in refractive error prevalence between private and public school children.<sup>4</sup> The fact that only public school children were included in this study might suggest a reason for lower prevalence of refractive errors observed. Of the eyes with reduced vision, almost 2/3<sup>rd</sup> (64.28%) improved with refractive correction which was similar to that reported in other studies in Nepal (56%)<sup>11</sup> and India (61%)<sup>3</sup>. However, the criterion used for defining reduced vision due to refractive error in this study was different than that used in studies from eastern Nepal and Kathmandu. In this study, refractive error was the cause of uncorrected reduced vision in an eye improving by at least 2 lines with correction. In studies from eastern Nepal and Kathmandu, eyes improving to 6/9 and better with correction were considered to have reduced vision due to refractive error. Contrary to these studies, larger proportions of eyes with reduced vision due to refractive errors were reported from China (94.9%).<sup>5</sup> This might possibly be due to majority of the Nepalese ethnic groups close to the Indian population.

#### Effect of age and gender

Students of 15 year of age had highest number of children with refractive errors possibly due to excessive reading. Children at this age are normally in grade 9 or 10. This is the time when they have to work hard to pass school board exams. Thus, excessive reading during this period might have increased the incidence. However, the SER in right and left eyes were not associated significantly with age and gender. Age was reported to be significantly associated with refractive error in another study as well.<sup>11</sup> Yet another study reported significantly more myopia among girls than boys ( $P < 0.01$ ).<sup>2</sup> Our study did not have sufficient numbers to make such deductions.

#### CONCLUSION

The incidence of reduced vision (1.2%) and refractive errors (2.06%) among school children of this semi rural district were low. Myopia was the dominant type of refractive errors accounting for more than 2/3<sup>rd</sup> of the refractive errors. Most of the myopia was found among older age group. As refractive correction could improve visual acuity in majority of the children, effective screening of refractive errors could help reduce the proportion of reduced vision among school children.

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