



ORIGINAL RESEARCH ARTICLE

MAGNITUDE OF REFRACTIVE ERRORS IN CHILDREN IN TERTIARY CARE HOSPITAL OF WESTERN NEPAL

Srijana Thapa Godar<sup>1,\*</sup>

<sup>1</sup>Department of Ophthalmology, Manipal College of Medical Sciences, Pokhara, Nepal

Received: 7 May, 2020

Accepted: 24 May, 2020

Published: 25 Jun, 2020

**Key words:** Amblyopia; Astigmatism; Myopia; Refractive error.

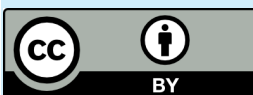
\*Correspondence to: Srijana Thapa Godar, Department of Ophthalmology, Manipal College of Medical Sciences, Pokhara, Nepal.

Email: [drsrijanathapa@gmail.com](mailto:drsrijanathapa@gmail.com)

DOI: <https://doi.org/10.3126/jcmc.v10i2.29674>

Citation

Godar ST. Magnitude of refractive errors in children in tertiary care hospital of western Nepal. Journal of Chitwan Medical College. 2020;10(32):54-58.



ABSTRACT

**Background:** Refractive error is one of the most common causes of the visual impairment and second leading cause of treatable blindness. The objective of the study was to determine the magnitude of refractive errors in children.

**Methods:** This was a hospital based cross-sectional study conducted on 254 children attending Ophthalmology OPD of Manipal Teaching Hospital, Pokhara. The children whose visual acuity was worse than 6/6 but improved with pinhole were included in this study. Vision test, retinoscopy and subjective refraction was done in all subjects and cycloplegic refraction was done when needed. Statistical analysis was carried out using Epi-info version 7.

**Results:** The commonest type of refractive error was astigmatism (46.06%) followed by myopia (42.31%). Majority of children had low grade of refractive errors (46.85%). Among the children, "with the rule astigmatism" was maximum (27.56%). Majority of children were in the age between 11 to 15 years (77.95%). The refractive error was seen more in female (63.78%). Among the children of refractive errors, 29.13% had family history, 33.46% had given the history of wearing spectacles and 10.24% children had amblyopia. There was statistically significant association between refractive errors and age groups, history of wearing spectacles, amblyopia and grading of refractive errors. However, there was no statistically significant association of refractive error with gender, residence and family history.

**Conclusions:** Astigmatism was the common type of refractive error followed by myopia. This study emphasizes the importance of detection of refractive error in children.

INTRODUCTION

Refractive error is an optical defect intrinsic to the eye which prevents the light from being brought to a single point focus on the retina thus reducing normal vision.<sup>1</sup> Childhood blindness due to uncorrected refractive error has emerged as a major public health problem, the cognizance of which has been taken by the World Health Organization in its Vision 2020 program. Globally, uncorrected refractive error accounts for upto 42% of visual impairment.<sup>2</sup> Refractive errors have become one of the leading causes for visual impairment and blindness, especially among children.<sup>3</sup> Approximately 12.8 million children in the age group between 5 to 15 years are visually impaired from uncorrected or inadequately corrected refractive errors, estimating a global prevalence of 0.96%.<sup>3</sup> Different studies reported the prevalence of refractive errors in children of Nepal as 6.20%,<sup>4</sup> 8.60,<sup>5</sup> and 19.8%.<sup>6</sup>

Poor vision in children can affect their participation and learning in the classroom.<sup>7</sup> This can interfere with education and career opportunities. Limited studies of refractive errors among children have been conducted in Nepal. The study showing the association between refractive error and age groups, gender,

residence, family history, history of wearing spectacles, amblyopia and grading of refractive errors is lacking in Nepal. This present study is conducted to eliminate this lacuna and for future planning to reduce the burden of visual impairment due to refractive errors in children. The objective of this study was to determine the magnitude of refractive errors in children in tertiary care hospital of Western Nepal.

METHODS

This was a hospital based cross-sectional study conducted in Ophthalmology OPD of Manipal Teaching Hospital, Pokhara, Nepal from June 2019 to November 2019. Ethical approval was taken from the Institutional Review Committee of the Manipal College of Medical Sciences, Pokhara before the start of the study. Informed consent was taken from all the patients.

The sample size was calculated by using the formula  $1.96^2pq/d^2$  (where; p=prevalence, 19.8%<sup>6</sup> q=100-p, 80.2%; d=margin of error, 5%). The sample size according to this formula was 254.

Children of age between 6 to 15 years, whose visual acuity was worse than 6/6 but improved with pinhole were included in the study sample. Patients with pseudophakia, aphakia, or

evidence of prior intraocular surgery or trauma were excluded from the study. Patients with refractive error in only one eye or different refractive errors in both eyes were also excluded from the study.

Relevant history was taken and detailed ocular examination was done including recording of visual acuity by using Snellen's letter chart, objective refraction with retinoscope (Heine Beta 200), auto refraction with Auto Keratorefractometer (Carl Zeiss Meditec AG) and subjective refraction. Cycloplegic refraction was done when needed. Anterior segment and fundus examination was carried out with slit lamp and with +90D Volk lens.

Refractive errors were classified according to the following definition

- Hypermetropia: Refractive error  $\geq +0.5$ . This was further classified as low hypermetropia ( $>+0.5D$  to  $<+3.0D$ ), medium hypermetropia ( $>+3.0D$  to  $<+6.0D$ ) and high hypermetropia ( $>+6.0D$ ).
- Myopia: Refractive error  $\geq -0.5$ . This was further classified as low myopia ( $>-0.5D$  to  $<-3.0D$ ), medium myopia ( $>-3.0D$  to  $<-6.0D$ ) and high myopia ( $>-6.0D$ ).
- Astigmatism: Any cylindrical error. Astigmatism was further classified as simple myopic astigmatism, simple hypermetropic astigmatism, compound astigmatism and mixed astigmatism.

tism and mixed astigmatism.

Astigmatism was further divided as "With the rule" when myopic astigmatism at  $180\pm 20^\circ$  or hypermetropic astigmatism at  $90\pm 20^\circ$ , and "Against the rule" when myopic astigmatism at  $90\pm 20^\circ$  or hypermetropic astigmatism at  $180\pm 20^\circ$ . Astigmatism at  $>20^\circ$  to  $<70^\circ$  or  $>110^\circ$  to  $<160^\circ$  was considered as "oblique" astigmatism.

The entry and analysis was done in Epi-info version 7. The statistical methods used were percentage and chi-square test. The p-value less than or equal to 0.05 were considered significant.

## RESULTS

A total of 254 children were examined in this study. Table 1 showed the frequency of different variables. The maximum numbers of children were found between the age group of 11 to 15 years (77.95%). In gender distributions, females (63.78%) were more as compared to males (36.22%). Among the children, 29.13% had given the family history of refractive errors, 33.46% had given the history of wearing spectacles and 10.24% had amblyopia. In this study, majority of children were from urban area (74.41%).

Table 2 showed the frequency of refractive errors. Astigmatism (46.06%) was commonest followed by myopia (42.31%) and hypermetropia (11.81%). Among the astigmatism, compound myopic astigmatism was common (24.02%).

**Table 1: Frequency of socio-demographic and clinical variables**

Variables		Number (%)
Age groups (in years)	6-10	56 (22.05)
	11-15	198 (77.95)
Gender	Female	162 (63.78)
	Male	92 (36.22)
Family history	No	180 (70.87)
	Yes	74 (29.13)
History of wearing spectacles	No	169 (66.54)
	Yes	85 (33.46)
Amblyopia	No	228 (89.76)
	Yes	26 (10.24)
Residence	Rural	65 (25.59)
	Urban	189 (74.41)

**Table 2: Frequency of refractive error**

Types of refractive error	Age Group		Total No. (%)
	6-10 years No.	11-15 years No.	
Myopia	16	91	107 (42.31)
Hypermetropia	18	12	30 (11.81)
Astigmatism	Compound Hypermetropic Astigmatism	1	2 (0.79)
	Compound Myopic Astigmatism	5	61 (24.02)
	Mixed Astigmatism	7	12 (4.72)
	Simple Hypermetropic Astigmatism	1	1 (0.39)
	Simple Myopic Astigmatism	8	41 (16.14)
Total	22	95	117 (46.06)

Table 3 showed that majority of children had low grade of refractive errors (46.85%) whereas, 5.12% had medium and 1.97% had high grade of refractive error. "With the rule" astigmatism was maximum (27.56%) followed by "against the rule" astigmatism (17.72%) and "oblique" astigmatism (0.79%).

Table 4 showed that there was statistically significant association between refractive errors with age groups, history of wearing spectacles, amblyopia and grading of refractive errors. However, there was no statistical significant association with gender, residence and family history.

**Table 3: Frequency of grading of refractive error**

Grading	Number (%)
Against the rule astigmatism	45 (17.72)
With the rule astigmatism	70 (27.56)
Oblique astigmatism	2 (0.79)
Low	119 (46.85)
Medium	13 (5.12)
High	5 (1.97)
Total	254 (100.00)

**Table 4: Relationship between refractive error and different variables**

Variables		Diagnosis			Total	$\chi^2$	p-value
		Astigmatism	Hypermetropia	Myopia			
Gender	Female	69	19	74	162	2.51	0.28
	Male	48	11	33			
Age Group (in years)	6-10	22	18	16	56	28.99	<0.001
	11-15	95	12	91	198		
Residence	Rural	32	11	22	65	3.54	0.16
	Urban	85	19	85	189		
Family History	No	82	26	72	180	4.32	0.11
	Yes	35	4	35	74		
H/o wearing spectacles	No	71	26	72	169	7.28	0.02
	Yes	46	4	35	85		
Amblyopia	No	99	24	105	228	14.64	<0.001
	Yes	18	6	2	26		
Grading	Against the rule	45	0	0	45	262.27	<0.001
	High	0	3	2	5		
	Low	0	24	95	119		
	Medium	0	3	10	13		
	Oblique	2	0	0	2		
	With the rule	70	0	0	70		

## DISCUSSION

This study showed 63.78% were females and 36.22 % were males. Similarly other studies also noted female participants were more as compared to male participants.<sup>8-12</sup> This finding was also similar with the study done in Libya which showed 51.9% females and 45.7% males.<sup>13</sup> However, this study finding is different from the study done in both Nepal and India which reported more male participants than female participants.<sup>14-17</sup> Maximum female participants in the current study could be because young females report more visual symptoms and also attain puberty earlier as compared to males.

In this study, 29.13% of children had family history of refractive errors. Another study done in India showed 59.59% children had family history of refractive errors.<sup>14</sup> Other different studies also supported this finding.<sup>9,15,17,18</sup> This indicated a presumed relationship between refractive error and heredity.

This present study found that 33.46% of children had given the history of wearing spectacles. Similarly, other studies also

showed 21.70% and 12.7% cases were using spectacles.<sup>14,16</sup> Study done in India showed 53.5% cases were using spectacles.<sup>19</sup> The possible reason could be a lack of awareness or shyness to wear spectacles and teasing from their friends.

In current study, majority of children were from urban area. Similarly, the different studies also observed that maximum number of participants were from urban than rural area.<sup>9,13,17,20</sup> One study found more participants from the rural area.<sup>15</sup> The children living in urban areas have to do lot of near work activities and also the duration of outdoor games was less as compared to children from rural areas. This can also be explained by the catchment area of the hospital where this study was conducted.

This study noted that 10.24% children had amblyopia. The studies conducted in India and Nepal found 7.07% and 7.62% had amblyopia.<sup>14,21</sup> Hence, this supports the need to look for amblyopia in all the children presenting with refractive errors.

In the present study, astigmatism was the most common refractive error followed by myopia and hypermetropia. Simi-

larly, other studies also found that maximum participants had refractive error of astigmatism followed by myopia and hypermetropia<sup>14-17,22</sup> while one study observed astigmatism (43.80%), hypermetropia (42.55%) and myopia (13.63%).<sup>23</sup> Many other studies found the commonest refractive error to be myopia followed by astigmatism and hypermetropia.<sup>11,12,19</sup> This could be explained by the facts that the hypermetropic children can accommodate to see clearly while it is not possible in case of children with myopia and astigmatism.

This study showed that majority of children had low grade of refractive errors (46.85%) whereas 5.12% had medium and 1.97% high grade of refractive error. Our study findings was similar with the study done in North India which showed 61.20% children had mild refractive errors and 3.32% had very severe grade of refractive error.<sup>14</sup> Another study in Nepal also found that majority of patients had mild to moderate refractive errors and high refractive errors was seen in 1.8% of patients.<sup>11</sup> Study conducted in Nigeria found more number of patients had low grade of refractive errors.<sup>12</sup>

In this study, there was statistically significant association between refractive error and age groups, the history of wearing spectacles, amblyopia and grading of refractive errors. However, there was no statistical significant association with gender, residence and family history of refractive errors. Other studies conducted in different part of India did not found significant difference in the prevalence of refractive errors between gender.<sup>16,20</sup> A study done in India also found statistically significant association between refractive errors and age groups<sup>16</sup> while

another study didn't observed statistically significant association between refractive errors and age groups.<sup>17</sup> One study done in Uttar Pradesh, India also not found the significant association with positive family history<sup>23</sup> whereas another study conducted in Bangalore, India found a very strong relationship between refractive errors and hereditary or familial factors.<sup>9</sup>

There are few limitations of this study. The data used for this study are cross-sectional and hospital based. Therefore, the findings of the present study cannot be extrapolated to the entire populations.

## CONCLUSION

Astigmatism was the common type of refractive error followed by myopia and hypermetropia. There was statistically significant association of refractive errors with age groups, history of wearing spectacles, amblyopia, grading of refractive errors and statistically insignificant association with gender, residence and family history. This study emphasizes the importance of detection of refractive error in children.

## ACKNOWLEDGEMENTS

The author would like to thanks all the participants of this study.

**CONFLICT OF INTEREST:** None

**FINANCIAL DISCLOSURE:** None

## REFERENCES:

- Woodall K. Spherical refraction for general eye workers. *Community Eye Health*. 2000;13(33):6-7. [\[PMID\]](#)
- Pascolini D, Mariotti SP. Global estimates of visual impairment: 2010. *Br J Ophthalmol*. 2012 May;96(5):614-8. [\[DOI\]](#)
- Dandona R, Dandona L. Refractive error blindness. *Bull World Health Organ*. 2001; 79:237-43. [\[LINK\]](#)
- Adhikari PR, Chaudhary SK, Karn RR, Singh SK. Pattern of refractive error among the children attending Biratnagar Eye Hospital, Nepal. *International Journal of Perceptions in Public Health*. 2019;3(3):66-73. [\[DOI\]](#)
- Adhikari S, Nepal BP, Shrestha JK, Khandekar R. Magnitude and determinants of refractive error among school children of two districts of Kathmandu, Nepal. *Oman J Ophthalmol*. 2013;6(3):175-8. [\[DOI\]](#)
- Pokhrel A, Pokhrel PK, Das H, Adhikari S. The patterns of refractive errors among the school children of rural and urban settings in Nepal. *Nepal J Ophthalmol*. 2010;2(2):114-20. [\[DOI\]](#)
- Negrel AD, Maul E, Pokhrel GP, Zhao J, Ellwein LB. Refractive error study in children: Sampling and measurement methods for a multicountry survey. *Am J Ophthalmol*. 2001; 129:421-6. [\[DOI\]](#)
- Dulani N, Dulani H. Prevalence of refractive errors among school children in Jaipur, Rajasthan. *Int J Sci Study*. 2014;2(5):52-5. [\[LINK\]](#)
- Pavithra MB, Maheshwaran R, Rani Sujatha MA. A study on the prevalence of refractive errors among school children of 7-15 years age group in the field practice areas of a medical college in Bangalore. *Int J Med Sci Public Health*. 2013;2(3):641-5. [\[DOI\]](#)
- Prema N. Prevalence of refractive error in school children. *Indian J Sci Technol*. 2011;4(9):1160-1. [\[LINK\]](#)
- Tuladhar S, Dhakal S. Refractive Error Profile in a tertiary Centre in Western Nepal. *Int J Infect Microbiol*. 2013;292:59-63. [\[DOI\]](#)
- Opubiri I, Adio A, Emmanuel M. Refractive error pattern of children in South- South Nigeria: A tertiary hospital study. *Sky Journal of Medicine and Medical Sciences*. 2013;1(3):10-4. [\[LINK\]](#)
- Elmajri KAK. A Survey of the Prevalence of Refractive Errors among Children in Lower Primary Schools in Darnah City, Libya. *Adv Ophthalmol Vis Syst*. 2017;7(5):378-83. [\[DOI\]](#)
- Mittal S, Maitreya A, Dhasmana R. Clinical profile of refractive errors in children in a tertiary care hospital of Northern India. *Int J Community Med Public Health*. 2016;3(5):1189-94. [\[DOI\]](#)
- Rai S, Thapa HB, Sharma MK, Dhakhwa K, Karki R. The distribution of refractive errors among children attending Lumbini eye institute, Nepal. *Nepal J Ophthalmol*. 2012; 4(1):90-5. [\[DOI\]](#)
- Hashia R, Slathia A. Pattern of Refractive Errors in Primary School Children in Rural Areas of Jammu City of Jammu and Kashmir, India. *Int J Sci Stud*. 2017;5(6):115-9. [\[LINK\]](#)
- Mittal J, Rizvi Y, Jain R. Clinical profile of Refractive Errors in School - going Children of Bareilly, Uttar Pradesh, India. *International Journal of Advanced and Integrated Medical Sciences*. 2017;2(4):169-72. [\[LINK\]](#)
- Ali A, Ahmad I, Ayub S. Prevalence of undetected refractive errors among school children. *Biomedica*. 2007;23(21):96-101. [\[LINK\]](#)
- Pradhan N, Sachdeva A, Goel T, Bhola B, Jha D. Prevalence of refractive errors among school children of 6-12 years of age group and reason for not using spectacles even after correction. *Int J Res Med Sci*. 2018;6(3):798-801. [\[DOI\]](#)

20. Kannan U, Rajendiran A, Yeraballi D, Shanmugavel K, John NA, Rene S. Refractive errors and associated risk factors in 6-12 years school children. *Natl J Physiol Pharm Pharmacol*. 2016;6(6):554-8. [\[DOI\]](#)
21. Pant BP, Ghising R, Awasthi S, Pant SR, Bhatta RC. Refractive status among the students presenting to Geta Eye Hospital, Kailali, Nepal. *Nepal Med Coll J*. 2010;12(2):95-9. [\[PMID\]](#)
22. Mehari ZA. Pattern of childhood ocular morbidity in rural eye hospital, Central Ethiopia. *BMC Ophthalmol*. 2014;14(1):50. [\[DOI\]](#)
23. Karki KGD, Karki M. Refractive error profile- a clinical study. *Kathmandu Univ Med J*. 2003;2(7):208-12. [\[LINK\]](#)