



ORIGINAL RESEARCH PAPER

Ophthalmology

A STUDY OF PREVALENCE OF REFRACTIVE ERRORS IN THE CATCHMENT AREA OF A TERTIARY CARE HOSPITAL IN NORTHERN INDIA

KEY WORDS: Refractive Errors, School children, Myopia, Spectacle use.

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ABSTRACT

Aim: Early detection and correction of Refractive Errors in children can improve probable visual outcomes in the future and also have a positive impact on the education and overall development of the child. The aim of this study was to establish the prevalence of refractive errors in school going children. **Materials And Methods:** An observational cross-sectional study was conducted among 864 school going children in the catchment area of a tertiary healthcare centre in Northern India. Children between ages of 5-16 years were assessed for ocular complaints; recording of visual acuity with Snellen's chart at 6 meters was followed by subjective refraction and a general torchlight examination. **Results:** The study reports that the overall prevalence of refractive errors is 21.9%. The prevalence of Myopia was 21.1%; Hypermetropia was 0.8% and Astigmatism was 4.7%. Only 10.9% of the children reported having any vision related complaints. 16.1% of the children with no ocular complaints had reduced visual acuity. 17.5% of the children were prescribed spectacles for the first time. **Conclusion:** School screening programmes are a cost effective and sensitive method of unearthing the hidden burden of visual impairment amongst school children. The need for proactive measures in uncovering and correcting refractive errors is underscored by the low reporting of problems by children, especially with the rise in prevalence of refractive errors witnessed after the global coronavirus pandemic.

INTRODUCTION

The visual system serves as an important conduit for information acquisition in humans. Learning by observation makes up an important part of the development and growth of humans as well as many animals. Any impairment to the function of this visual system, especially in children, can have significant deleterious effects on the development of personality, intellect as well as the development and refinement of the visual system itself.

Refractive errors can be described as irregularities or imperfections of the eye that affect the ability of the eye to place a focused image onto the retina. Refractive errors can be further classified as Myopia, Hypermetropia and Astigmatism. Uncorrected refractive errors are the leading cause of visual impairment globally as well as in children aged 5-18 years^[1] The future visual status of children with uncorrected refractive errors is at risk of developing disorders such as Amblyopia and Strabismus.^[2] The child also suffers from the negative impact on their education, career prospects, self-esteem and well-being.^{[2],[3]}

Early detection and correction of uncorrected refractive errors, especially in children, can significantly prevent morbidity and loss of productivity in later life. WHO recommends vision and eye-screening programs for school children aged 5-18 years to be conducted annually or once every 2 years.^[3] Screening camps are one of the most cost-effective strategies aimed at identifying individuals and encouraging them to avail corrective eye services.^[4] Uncorrected refractive errors can be corrected effectively by wearing spectacles, thus it is not merely a preventable cause of visual impairment but a readily correctable one, with the median pair of spectacles in Northern India costing approximately INR 300.^[5]

First reported on 31st December, 2019, a cluster of pneumonia cases of unknown aetiology from Wuhan spread rapidly to engulf the world in a crisis previously unseen.^[6] By March 11th, 2020 the WHO had raised the situation level to that of a

pandemic.^[7] India went on a complete lockdown of 21 days starting 24th March, 2020 which was further extended until 31st May, 2020. To curb the transmission of SARS-COV2 virus; strict rules like lockdown, social distancing, use of hand sanitizers, and face masks were instated. Like the general population, the children in India were also confined to their homes, their schools shuttered, playground out of reach and learning being shifted to online means of education.^{[8],[9]}

Prolonged near work has been found to be an important risk factor for development of Myopia.^{[10],[11]} Near work on an electronic display such as in a computer, for prolonged periods can result in extended exposure to hyperopic defocus which has been shown to drive axial growth of the eye and development of visual impairment.^{[12],[13]} The progression of visual impairment has also been shown to be positively linked with duration of computer use and time spent indoors.^{[14],[15]} Even as the restrictions have lifted, there have been long lasting alterations to the lifestyles of humans. The average child now has increased digital screen usage along with an increase in overall time spent doing near work tasks.^[5] Some authors already suspected the possible outcomes of home isolation on the RE of children; the term "Quarantine Myopia" was first used in 2021 to describe this alarming phenomenon by Klaver C.C.W. et al.^[16]

MATERIALS AND METHODS

This prospective cross-sectional study was conducted in the schools around Maharishi Markandeshwar Institute of Medical Sciences and Research, Mullana, Ambala, Haryana aimed at finding the prevalence of refractive errors in school going children aged 5-16 years. This study was approved by the institutional review board and is in alignment to the Declaration of Helsinki. Written informed consent for examination and inclusion in the study was taken from the guardian(s). Investigative team consisted of 1 Ophthalmologist and 2 Optometrists. After detailed history taking, each child's Visual Acuity was recorded at 6 meters using Snellen's Chart and Subjective Refraction was carried out, after which, each child was examined with torchlight. The

Statistical analysis was performed by using “descriptive and inferential statistics” using “chi-square test” and the software used in the analysis was “SPSS 29.0 version”. The p-value of <0.05 was considered significant.

Spherical equivalent (S.E.) of given correcting lenses was calculated. Myopia was defined as SE ≤ -0.50 D.; Hypermetropia as SE ≥ +0.50 D and Astigmatism as having a cylinder of ≤ 0.5 D. The study excluded any child aged less than 5 years or more than 16 years, any child with active ocular diseases like sty, blepharitis, conjunctivitis, etc.

RESULTS

The study examined 864 children between the ages of 5-16 years. Mean age of the study population was 10.55 ± 3.37 years with 64% males. Overall prevalence of Refractive Errors was 21.9%. The prevalence of Myopia, Hypermetropia, Astigmatism was 21.1%, 0.8% and 4.7% respectively. Our study discovered that 17.5% of the children were prescribed spectacles for the first time. Only 9.1% of the children were found to be wearing spectacles at the time of examination. 16.1% of the children who had visual acuity < 6/6 reported having no vision related problems and only 10.9% were aware of any visual problems.

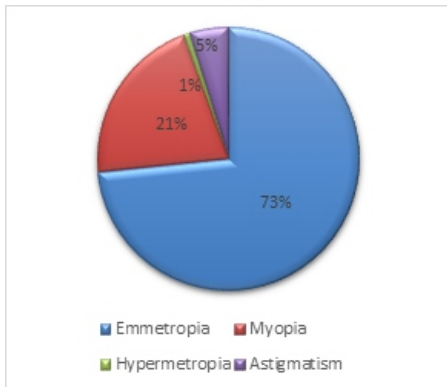


Figure 1:Prevalence of Refractive Errors



Figure 2:Spectacle usage amongst participants

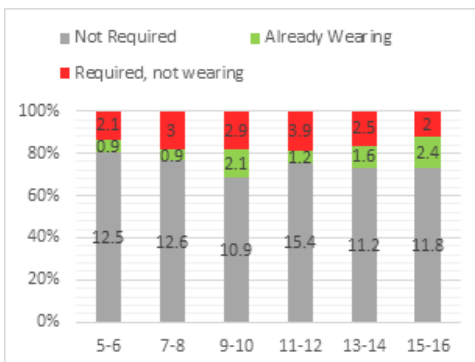


Figure 3:Age-wise spectacle usage amongst participants



Figure 4:Sex wise distribution of spectacle usage

Table 1: Frequency of Ocular Complaints (DOV= Diminution of vision)

Complaint	Frequency	Percentage
No complaints	770	89.1%
DOV in both eyes	75	8.7%
Headache	11	1.2%
Headache with DOV	3	0.4%
DOV in right eye	2	0.2%
DOV in left eye	3	0.4%
Total	864	100

DISCUSSION

Uncorrected refractive errors remain the foremost cause of visual impairment globally as well as in school children aged 5-18 years.^[3] It presents grave dangers to the future sight of children that are vulnerable to development of disorders such as amblyopia or strabismus.^[2] Children also suffer from the negative impacts on their education, career prospects, self-esteem and well-being.^{[2],[3]} The enormity of the problem at hand can be gauged by the estimate that the number of children and teenagers with myopia is expected to have risen by 200 million from 2000 to 2050.^[3]

Our study covered 864 children between the ages of 5-16 years of which 64% were Males and 36% Females. The disparity in genders was most likely due to prevalent cultural norms practiced in the area or due to the inclusion of a school which catered specifically to a career in the Defence forces. A similar study of the region describes the composition of their study population as being 51.3% Male and 48.7% Female.^[6] Mean age of the study population was 10.55 ± 3.37 years which is close to the mean age of 10.92 ± 2.73 years as reported in a 2024 study conducted by BHU-IMS, Varanasi, Uttar Pradesh.^[17]

The leading problem in unearthing the burden of disease in children lies in low reporting rates of vision related complaints. This could be due to the child or parents being unaware of what to look for or the child being unable to convey the difficulty faced by them or that the child unintentionally adopts compensatory behaviours. As seen by Srivastava T et al, only 37.8% of children with visual impairment reported any complaints.^[17] This behaviour is echoed in our findings that only 10.9% of the children reported having any vision related complaints. Of the 770 children that had no complaints there were 124 children (16.1%) that had Visual Acuity < 6/6 upon testing with Snellen's chart, which indicates that children under-report their visual complaints (p<0.01).

Our study discovered that 17.5% of the children were prescribed spectacles for the first time. Only 10.9% of the

children were found to be wearing spectacles. The greatest number of new spectacles were prescribed to the age group of 11-12 years while 15-16 year old children had the highest number of pre-existing spectacle users. By the time children reach 15-16 years of age, asthenopic symptoms are more readily reported, owing to increased academic work. This may have prompted seeking of eyecare services in 15-16 year olds leading to better spectacle coverage. Among the children with newly prescribed spectacles, females (17% of 311) were marginally more than the males (16.1% of 553) which could be due to the prevailing socio-cultural acceptances regarding appearances. Beg S et al reported that in their 2020 study in Karnataka 85.71% participants with R.E. were not using spectacles.^[18] Another study conducted in Jhajjar, Haryana by Malhotra S et al found that 10.8% of participants had requirement of spectacles.^[9] Srivastava T et al found that 51.56% of their study population of 5-16 year old children were newly diagnosed with RE.^[17] However, a study conducted in Kerala by Sathyan S et al in 2018 found that only 1.18% of children required new spectacles.^[19] This brings to light the unequal coverage of eyecare services seen across regions and the need of extensive and inclusive steps to be undertaken to remedy this preventable cause of visual impairment.

Taking the data regarding the refractive status of the right eye, Overall prevalence of Refractive Errors was 21.9%. The prevalence of Myopia, Hypermetropia, Astigmatism was 21.1%, 0.8% and 4.7% respectively. A study conducted in Varanasi, Uttar Pradesh through December 2022 to October 2023 by Srivastava T et al reports overall prevalence of refractive errors to be 17.43%, which was higher in urban areas (22.14%) than in rural areas (13.12%).^[17] Our study was conducted in an area that has a prominent university alongside rural landscapes which results in a population of children in which urban and rural socio-economic and cultural traits are dispersed rather homogenously which could explain the high overall prevalence of refractive errors. Other studies such as K. Vanitha et al (2021) reports the prevalence of refractive errors in Vishakhapatnam, Andhra Pradesh to be 12.74% while Beg S et al (2020) reports the prevalence of refractive errors to be 18.61% in Wardha, Karnataka.^{[17],[20]} Various other studies conducted across the country before the Covid Pandemic (prior to December, 2019) have reported the overall prevalence of refractive errors ranging from 2.38%^[21], 10.8%^[22] to 11.8%^[23].

The prevalence of Myopia in school children was found to be 13.1% in 2015 by the North India Myopia Study (NIMS) which was centred in Delhi.^[14] A 2018 Meta-analysis reports the population-based prevalence of Myopia to be 5.3%.^[22] The aftermath of Covid-19 pandemic has seen a dramatic rise in the number of myopia cases. Prevalence of myopia has been reported to be as high as 19.53% in 2021 and 86.5% in 2022 as reported from Tamil Nadu.^{[24],[25]} More studies conducted all over the world after the pandemic have shown a similar increase in the prevalence of myopia.^{[26],[27],[28]} This increase in the burden of myopia has been attributed to the increase in time spent indoors, increased near work, increased use of digital devices, and less time spent outdoors in bright light.^[9-15] Myopic shift of SE has been reported across multiple studies. Yang et al^[27] report that 12-month S.E. progression of -0.38 ± 0.96 D was seen in China, with similar reports from studies held in Germany^[29], Spain^[28] and Italy^[26]. Our study has seen a similar myopic shift of Spherical Equivalent across all ages especially around 9-10 years of age which resonates with the findings of Diez et al that the highest refractive and myopia changes occurred in 8-11 years of age.^[29] This could be due to the faster rate of progression of myopia and axial elongation reflecting the crucial ocular and refractive plasticity at this age window.^{[10]-[13]}

CONCLUSION

Refractive errors, especially Myopia, are common among

Indian school-going children and comparison with earlier studies suggests that it may be growing at a rather alarming rate. The Covid-19 pandemic brought about significant changes to the lifestyles of people. Reduced time spent outdoors or in bright light, increased near work, and increased portion of that near work being done on screened gadgets has led to a sharp rise in the prevalence of refractive errors as well as increased incidence of myopia at a younger age. Early detection and correction of refractive errors in children can not only improve probable visual outcomes in the future but also have a positive impact on the education and overall development of the child. School screening programs like the one conducted in this study, are cost effective and sensitive to unearthing the hidden burden of visual impairment. This study also highlights the fact that children often under-report visual problems and discomfort which further underscores the importance of regular screening.

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