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Pattern of Errors of Refraction among Children Attending Ophthalmic OutpatientClinic in Suez Canal University Hospital

Reham M. Abd Elkhalik[1*], Osama M. El-Bassiouny[2], Hussein S. El nahass[2], Rasha M. Farghaly[3]

[1]*Department of Ophthalmology, Port Said Ophthalmology Hospital, Egypt*
[2]*Department of Ophthalmology, Faculty of Medicine, Suez Canal University, Egypt.*
[3]*Department of Occupational Medicine, Faculty of Medicine, Suez Canal University, Egypt*

Abstract

***Background*: The eye health care program used systematic referrals and quick management by qualified ophthalmologists at secondary and tertiary levels as well as early detection of blinding eye illnesses at the primary health level in the last ten years to reduce childhood blindness. *Aim:* to describe the incidence of errors of refraction of children attending the ophthalmic outpatient clinic at Suez Canal University Hospital to have a better insight into our ophthalmic problems and update our investigation and management to overcome this problem. *Patients and Methods:* This descriptive cross-sectional study was carried out on 331 children who attended the ophthalmic outpatient clinic in Suez Canal University Hospital for 3 months in the period from January 2019 to April 2019. *Results:* The most common refraction error among the studied participants was astigmatism 75.2% followed by hypermetropia with 16% and myopia with 8.8%. Among astigmatism, the most common subtype was myopic astigmatism (36.2%). The study included 178 (53.8%) girls and 153 (46.2%) boys with a Mean age of 7±2 years. A family history of refractive errors was 215(65%) positive. REs in our study were more in females than males and in rural areas than in urban areas. Amblyopia was seen in 51.8%. *Conclusion:* We discovered that most of the affected children were in the school age range, highlighting the significance of screening schools for REs among school children. We also covered in our study how a family history was typical in children with refractive error.**

Keywords: Errors of Refraction, Children, Pediatric amblyopia.

Introduction

Clear vision is a key indication of refractive error, a disorder in which light cannot focus on the retina due to the optical power of the eye. Refractive error is thought to be caused by a mix of environmental and hereditary factors[(1)]. Due to errors of refraction, which affect a large number of populations worldwide regardless of age or sex, society bears a heavy financial burden. Errors of refraction are the second most common cause of curable blindness and the most common cause of visual im

*Corresponding Author: reham.abdelkhalek@med.suez.edu.eg

pairment in children at school age[2]. Globally, 161 million people were reported to be visually impaired due to conditions like cataract, trachoma, and onchocerciasis (refraction errors were not counted as a contributing factor in these statistics)[3]. Due to their significant impact on the occurrence of visual impairment, the WHO, and the International Agency for the Prevention of Blindness (IAPB) have since made every effort to include uncorrected refraction errors in such statistics through the global initiative VISION 2020: The Right to Sight. Therefore, as of October 12, 2006, the WHO estimated that 153 million individuals worldwide have low vision or are blind as a result of uncorrected refractive defects, with at least 13 million children (5–15% of children between the ages of 5 and 15) affected[4]. Uncorrected refractive defects are now the second leading cause of avoidable blindness (18%), behind cataracts (39%)[5]. Errors of refraction are a serious health concern in Egypt that are correlated with social status, tradition, environmental pollutants, and high traffic[6]. Myopia was the most common type of refraction error found worldwide, according to studies conducted in Malaysia (77.5%), Qatar (25.54%), Nepal (59.8%), India (20.65%), Jordan (31.05%), and Saudi Arabia (65.7%) among children between the ages of 6 and 14[7]. Additionally, they discovered that the proportion of children with refractive defects varies from rural to urban locations. Although there were more and better health care available in rural areas, the prevalence was still greater there. Given that myopia increases as education levels rise, this may be attributable to urban areas experiencing a higher rate of education growth than rural ones[8]. Refraction errors are simple to identify and correct using glasses or other devices to allow for normal vision, but if they are not treated and corrected properly, they may be a major cause of visual impairment and blindness[9]. The rate of refractive error correction in children between the ages of 5 and 15 is dropping for a number of reasons, including a lack of community awareness of the issue and a lack of screening tools. However, studies where free and simple routine screening programs and tools to correct refractive problems are present reveal that cultural barriers and beliefs might play a role[10]. Spectacles delivered without charge as part of insurance coverage were worn less frequently than those the patient had to pay for, according to a Tanzanian study. Another reason is the lack of various types, forms, colors, and sizes of eyeglasses, as only one size that fits all ages is deemed unfashionable. Since the youngsters do not complain of uncorrected visual acuity (UCVA) and do not wear glasses, little refractive errors may not be corrected[11]. Therefore, the purpose of our study is to assess the frequency of errors of refraction among children attending outpatient clinic in Suez Canal university hospital to determine the extent of this important health problem. This study aimed to determine the frequency of errors of refraction among children attending outpatient clinic in Suez Canal university hospital to help nationwide in planning the intervention.

Patients and Methods

This descriptive cross-sectional study was conducted on 331 children who attended ophthalmic outpatient clinic in Suez Canal university hospital for 3 months in the period from January 2019 to April 2019 in the ophthalmology outpatient clinic of Suez Canal university hospital. Children who were under 12 years old of both gender were included in the study. Patient with history of ocular trauma, intraocular surgery, organic causes of low visual acuity as media opacities or retinal lesions, or in emergency were excluded from the study.

Sampling technique:

A comprehensive sample of all children who are under 12 years old attended ophthalmological outpatient clinic in Suez Canal University hospital fulfilling the inclusion and exclusion criteria was carried till thesample size was reached.

Methods

Enrolled patients were evaluated by full history and examination by a pre-designed checklist in conjunction with a designed database computerized program for data entry and analysis.

Medical history: was taken including name, age, sex, history of wearing glasses, previous intraocular surgery, ocular trauma, any systemic diseaseas diabetes mellitus.

*Ophthalmic examination***:**

1) *Visual acuity testing using Snellen's chart.*

The distant visual acuity of each eye was measured using Snellen's E-chart at 6 m with standard lighting without and with spectacles, if present. And using cards for non-verbal children as kay pictures card, broken wheel cards, Cardiff cards and lea symbols cards by matching the pictures

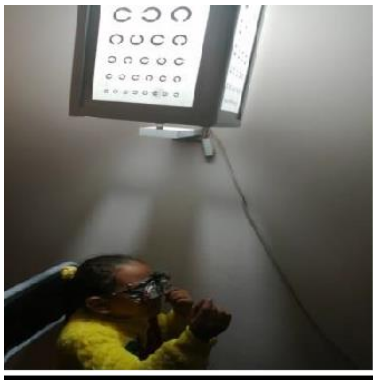

Figure 1: VA examination of 6 years old child using chart

2) Assessment of ocular motility and alignment without and with spectacles, if present.

3) External examination using simple pin light illumination for gross media opacity, lid position, lid disease and pupil light reflexes.

4) Examination of the anterior segment using slit-lamp biomicroscopy. (Topcon slit lamp SL3). This included:

a. Examination of the cornea for any opacity following ulcer or trauma, keratoconus, irregularity of its surface, previous surgery, anomalies.
b. Examination of the anterior chamber and its angle usinggonio lens in cooperative children. This step is important before undergoing cycloplegic and mydriasis in children with narrow angle especially if previously diagnosed as high hypermetrope.
c. Lens: opacity (congenital cataract, trauma), subluxated or dislocated, lens extraction and intraocular lens implantation.
d. Anterior chamber examination for diseases (e.g., uveitis "cells or flare").

Refraction without and with cycloplegia. Cycloplegia wasachieved using 1 drop of cyclopentolate hydrochloride (1.0% eye drop) instilled 3 times in the inferior conjunctiva culde-sac, at intervals of 10 minutes. An objective automated refraction was performed with children above 5 years using autorefractometer(Nidek ARK 530A Auto Ref / Keratometer,Japan) Three reliable readings were obtained in each eye, and the average of these values was used for analysis, Children below 5 years refraction was performed sing retinoscope (Neitz,japan).

A B C B

Figure 2:Different visual acuity assessment cards: (2a) cardiff card. (2b) kay pictures card. (2c) broken wheel card. (2d) lea symbol card.

2- *Funduscopic examination, Dilated fundus examination:*
Using direct (RI-scope l/Riester) and indirect ophthalmoscopy (Appasmy associates) to examine the lens, vitreous, macula, optic nerve and peripheral retina and with general anesetheia in non-cooperative patient.

3-intra ocular pressure measurement:
using Goldmann applanation tonometer (shin-Nippon) for only cooperative child.
Refractive errors were classified according Althomali[12] to the following criteria**:**
Refractive error of at least +0.5 D indicates hyperopia. Additional classifications included Low (+0.50D to +3.0D), Medium (+3.0D to +6.0D), and High (+6.0D and above).
Myopia: A minimum refractive error of -0.5 D Low (-0.50D to -3.0D), Medium (-3.0D to -6.0D), and High were further classifications for this (more than -6.0D).
Astigmatism: There are several types of astigmatism, including Simple Hyperopic Astigmatism (SHA), Simple Myopic Astigmatism (SMA), Compound Hyperopic Astigmatism (CHA), Compound Myopic Astigmatism (CMA), and Mixed [12].

Statistical Analysis

The Statistical Package for Social Science (SPSS) version 22 was used to code the data and enter it into the computer statistical program. Quantitative data were presented as mean Standard Deviation, whilst qualitative data were given as numbers and percentages. The significance of variations in quantitative variables across groups was examined using the student t test, while qualitative variables were examined using the chi square test. To evaluate the correlation between various quantitative variables, Pearson's correlation coefficient was used. A P value of 0.05 or lower was deemed statistically significant.

Figure 3: Anterior segment examination in 11years old child using slit lamp

Figure 4: VA examination in 5years old child using autorefractomy

Figure 5: Fundus examination of dilated pupil in 10 years old child

Ethical considerations

Patients were informed about the study and its objectives. An informed written consent was obtained from every patient. The steps of the study, its potential benefits, risks or complications were discussed with each individual patient. Each patient was offered the proper management accordingly. The patients were notified about the clinical examination and investigations. To ensure data confidentiality, a code number addressed each patient for contact. None of the patients' data was distributed outside the field of medical research and every effort was done to preserve patient's privacy and dignity. Patient had a right to refuse participation or withdraw any time during the study.

Results

Children who attended outpatient clinic in Suez Canal university hospital in the period of our study were 1350 child 331(24.5%) of them had errorsof refraction who were enrolled in our study. The general characteristics of these children were studied and showed 178 (53.8%) were girls and 153 (46.2%) were boys.

Table 1: the general characteristics of studied patients.

General characteristics		
Age *(Years)*	*Mean±SD*	7±2
	Range	(1-11)
Gender *Freq. (%)*	*Male*	153 (46.2)
	Female	178 (53.8)
Resident *Freq. (%)*	*Urban*	131(39.6)
	Rural	200(60.4)
Family history *Freq. (%)*	*Positive*	215 (65)
	Negative	116 (35)
Wearing glasses *Freq. (%)*	*Yes*	131 (39.6)
	No	200 (60.4)

About 131 (39.9%) came from urban areas and 200(60.4) from rural area. Mean±SD age of the children was 7±2 years. Among them, 163 (49.2%) were wearing glasses. Family history of refractive errors was 116 (35%) positive, all these general characteristics were explained in table 1**.** The Relation between wearing glasses and residence among the studied patients is not statistically significant (P-value >0.05) as shown in table 2. The most common refraction error among the studied participants was astigmatism which was 75.2% (498) followed by hypermetropia with 16% and myopia with 8.8% as was presented in figure (5 and 6). Table 3 showed that the most common type was astigmatism which was 75.2% (498) followed by hypermetropia with 16% and myopia with 8.8%. Among astigmatism the most common sub type was myopic astigmatism 240(36.2%). The Relation between general characteristics of the studied patients and types of errors of refraction showed only that those with hypermetropia were of younger age and the majority with error were living in rural areas, and these differences are statistically significant (P-value <0.05) in table 4. The number of amblyopic eyes in our study was 6(0.9%) eyes from 662 eyes. As all cases were unilateral amblyopia the percentage of amblyopia in the cases in our study was 1.8% (6 cases from total 331) (table 5). Table 5 showed that

the relation between General characteristics of the studied patients and amblyopia is not statistically significant (P-value >0.05).

Table 2: the relation between wearing glasses and residenceamong the studied patients (n=331).

Residence *Freq. (%)*	Glasses		*P-value*
	Present (n=6)	Absent (n=325)	
Urban	80(61%)	51(25.5%)	0.567
Rural	51(39%)	149(74.5%)	

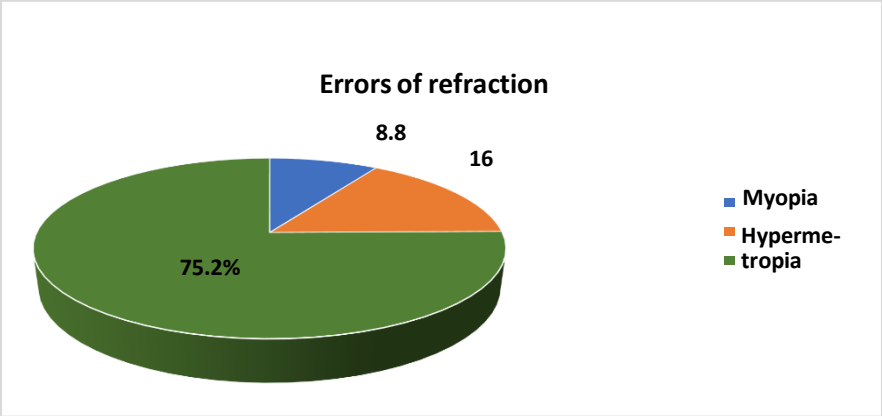

Figure 3: Types of errors of refraction among the studied patients (n=331).

Table 7 showed that the relation between types of errors of refraction and amblyopia among the studied patients is not statistically significant (P->0.05). The Relation between sub-types of errors of refraction and amblyopia among the studied patients was not statistically significant (P >0.05) (Table 8).

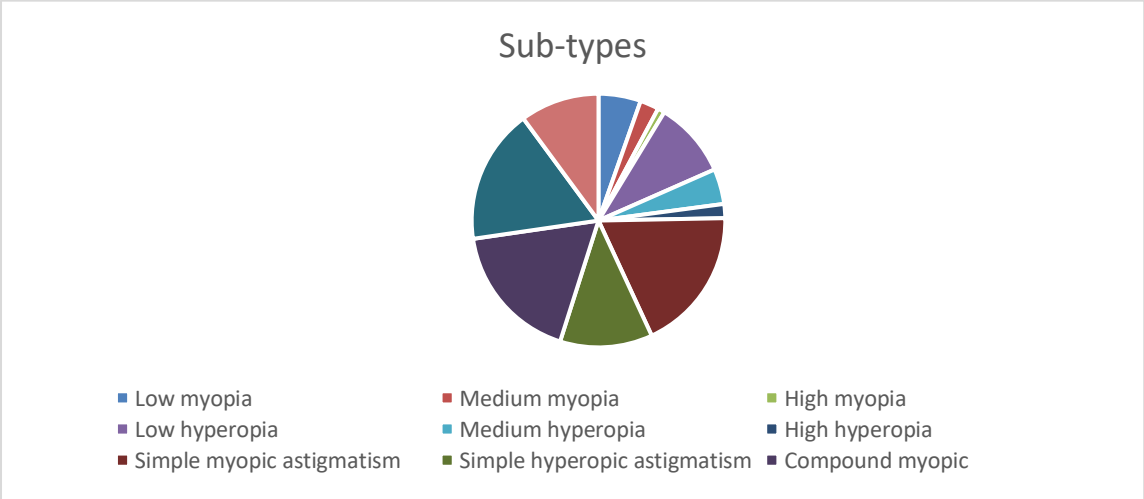

Figure 4: Sub-types of errors of refraction among the studiedpatients (n=331).

Discussion

Only 331 of the 1350 children who attended the ophthalmic outpatient clinic at Suez Canal University Hospital during the study period had refractive errors, which was less than the prevalence of 24% found in a 2016 study by Elmajiri et al.[13] among primary school students, but higher than the prevalence of 29.4% found in a 2015 study by Yamamah, et al. in South Sini, Egypt [8]. 95 children from 142 (66.9%) had a substantial refractive error of 0.50 or worse in one or both eyes, according to Azzam Mohamed et al, study[14]. However, the prevalence of REs in our study was higher than that in the following studies: According to studies by Mourad, et al. [15] and El-Masry et al.[16] in Cairo, Egypt, RE prevalence among school children aged 7 to 14 was 7.1% and 22.1%, respectively.

Table 3: The prevalence of different types of REs among the studied participants (n=662).

Refractive error	No. (%)	Sub types of refractive errors	No. (%)
Myopia	58 (8.8%)	Low myopia	5.4%
		Medium myopia	2.4%
		High myopia	0.9%
Hypermetropia	106 (16.0%)	Low hyperopia	9.7%
		Medium hyperopia	4.5%
		High hyperopia	1.8%
Astigmatism	498 (75.2%)	Simple myopic astigmatism	18.4%
		Simple hyperopic astigmatism	11.8%
		Compound myopic astigmatism	17.8%
		Compound hyperopic astigmatism	17.2%
		Mixed astigmatism	10.1%
Total	662 (100%)	Total	662 (100%)

Additionally, according to a 2020 study by Elsabagh and Elseht, the prevalence of REs was 22.1%. The size and kind of the sample that was used and the amount of parental knowledge on the importance of getting their kids' eyes checked may be to blame for the variations in results between the several studies conducted in various parts of Egypt[17]. Comparing our study to those of other nations, it was discovered that our results were in agreement with an Indian study[18] by a margin of 25.1% and were higher than those of studies carried out in Saudi Arabia[19] by a margin of 9.8% among intermediate school students, Malaysia, 7.7%[1], Nepal 8.6% [20]. Given that REs may be seen as the product of a combination of genetic and environmental factors, this difference may be connected to the sort of sampling technique employed, the size of the population screened, and the variation in geographic location in these studies. 53.2% of female children had refractive error, compared to 46.8% of male children, according to our study. This was consistent with studies conducted in Riyadh, Saudi Arabia among intermediate school students, where it was reported a prevalence of 11.7% among females compared to 8.3% among males [17].

Table 4: Relation between General characteristics of the studied patients and types of errors of refraction (n=331).					
General characteristics		**Types of errors of refraction**			***P-value***
		Myopia (n=29)	**Hypermetropia (n=53)**	**Astigmatism (n=249)**	
Age *(years)*	*Mean±SD*	8±3	6±3	7±3	*0.028**
	Median	9 (2-11)	6(1-11)	7(2-11)	
Gender *Freq. (%)*	*Male*	9 (31)	31(58.5)	112(45)	*0.052*
	Female	20 (69)	22(41.5)	137(55)	
Residence *Freq. (%)*	*Urban*	9 (31)	15(28.3)	118(47.4)	*0.015**
	Rural	20 (69)	38(71.7)	131(52.6)	
Family history *Freq. (%)*	*Present*	27 (81.8)	31(60.8)	157(63.6)	*0.15*
	Absent	6 (18.2)	20(39.2)	90(36.4)	

***** *Statistically significant (P-value <0.05) by using Kruskal wallis test*

Table 5: The prevalence of amblyopia among the studied participant's eyes. (n=662).		
Amblyopia	**No.**	**%**
Present	6	0.9%
Absent	656	99.1%

Additionally, similar findings were reported from Qatar[21], where there was a prevalence of 23.7% among females and 15.5% among males for refractive errors, India[22], Ghana[23], but disapproved of a 2017 study by Hashemi, A et al. [24] conducted in Nepal with 67% men and 33% omen. Additionally, it has been proposed that girls' earlier maturation and pubertal alterations may account for this finding. Additionally, it has been hypothesised that girls are more likely than boys to report visual issues[25]. A study by Carter et al.[26] on the other hand, showed no correlation between RE and either gender or residence.

Table 6: Relation between General characteristics of the studied patients and amblyopia (n=331).				
General characteristics		**Amblyopia**		***P-value***
		Present (n=6)	**Absent (n=325)**	
Age *(years)*	*Mean ±SD*	7.1±1	6.9±3	*0.893*
	Median	7 (1-11)	7 (1-11)	
Gender *Freq. (%)*	*Male*	3 (50)	149 (45.8)	*1*
	Female	3 (50)	176 (54.2)	
Residence *Freq. (%)*	*Urban*	1 (16.7)	141 (43.4)	*0.243*
	Rural	5 (83.3)	184 (56.6)	
Family history *Freq. (%)*	*Present*	5 (83.3)	196 (60.3)	*0.41*
	Absent	1 (16.7)	129 (39.7)	
Wearingglasses *Freq. (%)*	*Yes*	2 (33.3)	143 (44)	*0.699*
	No	4 (66.7)	182 (56)	

It has been hypothesised that differences in preferences between genders for daily activities may have a greater impact on the outcome than gender alone; especially, female children may favour more indoor activities and close-up work than male youngsters[26]. According to this study, there were 57.1% more cases of refractive error in rural areas than in urban areas (42.9% vs. 42.9%). It's possible that this is because eye diseases are harder to identify in rural areas due to poor access to eye care facilities, low socioeconomic position, and low family literacy rates. This conclusion was in agreement with a Nepal study by Adhikari, et al., [27] which included 69% rural and 31% urban participants. While disagreeing with study, about 23.7% of the children with refractive errors were from rural areas, whereas 76.3% of the normal children were from rural areas, and also about 24.7% of children with refractive errors were from rural areas [24]. They cited low accessibility of health care facilities as the main reason for this. Due to the use of smart phones and the expansion of nearby employment in urban rather than rural locations.

Table 7: Relation between types of errors of refractio and amblyopia among the studied patients (n=331).

Types of errors of refraction *Freq. (%)*	**Amblyopia**		*P-value*
	Present (n=6)	**Absent** (n=325)	
Myopia	0(0)	29(8.9)	0.324
Hypermetropia	2(33.3)	51(15.7)	
Astigmatism	4(66.7	245(75.4)	

Our research revealed that astigmatism was extremely widespread in this study, making up 75% of REs, followed by hypermetropia (16%), and myopia (9%). studied by Ali et al. in the Delta region [28], with 67.8% and Astigmatism was more common than in Ghana (55%)[23]. Wen and colleagues discovered that non-Hispanic white preschoolers with hypermetropia had a higher prevalence rate (25.6%) than Asian preschoolers (13.47%) [7]. Yi and coworkers discovered that myopia was the most common refractive error (31.6%) among Ethiopian children[29], while Carter and colleagues observed that Paraguayan youngsters were notably hyperopic and largely free of myopia[30]. These variations demonstrate that refractive error and vision differ depending on sex, age, location, and population patterns. According to the current findings, amblyopia was identified in 1.8% of children in our study. Nationally, there is a reduction of data referring to the magnitude of but smaller than the study carried out in the Delta by Ali et al.[28] with 10.3% among children, the study carried out in the Menoufia area by Elsabah[17] with 8%, and the study carried out in Nepal by Hashemi et al[1] with 2.3%. According to an African study, the prevalence was 0.6% in Ghana and 0.2% in Nigeria [31]. Children in Australia were subject to the prevalence, which was 0.7%[32]. Astigmatism was the most prevalent kind of refractive error among amblyopic eyes in this study, accounting for 66.7% of cases. A similar finding was made in studies from China (92%), India (92%), and Kathmandu (59%). 1.8% of children with 6 eyes were found to have

amplyopia, which was more prevalent in rural areas (83.3%) than in urban areas (16.7%) and in both males and females[6]. The same result was observed in India, where the Chennai Tertiary Eye Hospital discovered that amblyopia was more prevalent in rural areas (67.21%) but more so in males (63.79%)[33].

Table 8: The Relation between sub-types of errors of refraction ar amblyopia among the studied patients.

Sub-types of errors ofrefraction *Freq. (%)*	Amblyopia		*P-value*
	Present (n=6)	Absent (n=325)	
Low myopia	0(0)	18(5.5)	*0.097*
Medium myopia	0(0)	8(2.5)	
High myopia	0(0)	3(0.9)	
Low hypermetropia	1(16.7)	35(10.8)	
Medium hypermetropia	0(0)	13(4)	
High hypermetropia	1(16.7)	3(0.9)	
Simple myopic astigmatism	0(0)	61(18.8)	
Simple hypermetropic astigmatism	2(33.3)	37(11.4)	
Compound myopic astigmatism	0(0)	59(18.2)	
Compound hypermyopicastigmatism	2(33.3)	55(16.9)	
Mixed astigmatism	0(0)	33(10.2)	

Our study found that 65% of kids with REs had a positive family history of eyewear, with at least one parent having worn glasses. This result was consistent with a study with a 63.1% positive family history, which may support the genetic factor theory [34]. In our study, only 39.6% of children wore glasses, which was similar to study, where only 31% of children wore glasses [15]. This showed a lack of knowledge about the significance of routine eye exams for children, even those with high levels of education.

Conclusion

Out of a total of 1350 children, 24.5% had visual impairment caused by refractive error, particularly astigmatism with 75.2% and amblyopia with 1.8%. These conditions were more prevalent in female children from rural areas, which encouraged us to pay attention to these areas in particular to their children. We discovered that most of the affected children were in the school age range, highlighting the significance of screening schools for REs among schoolchildren. We also covered in our study how a family history was typical in children with refractive error. Therefore, it is imperative to construct a nationwide programme for the early diagnosis of visual impairment that includes all paediatric age groups, from infants to children in preschool and school, as early REs screening may change the prognosis and treatment efficacy.

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