

Frequency of Refractive Errors in Squinting Eyes of Children from 4 to 16 Years Presenting at Tertiary Care Hospital

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Abstract: *Purpose:* To determine the frequency of refractive errors in squinting eyes of children from 4 to 16 years presenting at tertiary care hospital. *Study Design:* A descriptive cross-sectional prospective study was done. *Place and Duration:* The study was conducted in Paediatric Ophthalmology, Hayatabad Medical Complex, Peshawar. The duration of the study was 15th Sep to 15th Oct, 2021. *Materials and Methods:* Sample size was 146 keeping 41.45% proportion of refractive errors in children with squinting eyes, 95% confidence interval and 8% margin of error under WHO sample size calculations. Non-probability consecutive sampling was done. *Result:* Mean age was 8.57 ± 2.66 years. Male were 89 (61.0%) and female were 57 (39.0%). Refractive error was present in 56 (38.4%), including 9 myopic, 32 hypermetropic, and 15 astigmatic children, and was absent in 90 (61.6%) patients. 57 positive parent refractive error patients, 21 (36.8%) showed refractive errors. However, In 89 patients without parent refractive errors, 35 (39.3%) showed refractive errors, p value 0.763. Early use of electric equipment against the refractive error showed that of total 56 patients with early use of electric equipment, 24 (42.9%) showed refractive errors. In 90 patient without the early use of electric equipment, 32 (35.6%) showed refractive errors There was no association of gender, age, parent refractive errors or early usage of electric equipment with the refractive errors. *Conclusion:* Prevalence of refractive errors is high in patient with strabismus. There is no association of age, gender, parent refractive errors or early usage of electric equipment in the occurrence of refractive errors. Further studies are recommended for confirmation of these.

Keywords: Strabismus, Refractive Error, Myopia, Hypermetropia, Astigmatism

1. Introduction

Strabismus is a term used for misalignment of eyes. The mechanism understood is lack of integration of information from both eyes. Squint is classified as latent/manifest and primary/secondary due to refractive errors or tumors of extra ocular muscles [1]. It results in amblyopia due to abnormal binocular interaction provided that there is no ocular or visual pathway pathology [2]. Refractive errors are of three types; that is, Myopia, Hypermetropia and Astigmatism. Myopia is a condition in which either the length of eye or power of cornea/lens is increased resulting in image formation in front of the retina, while hypermetropia is a condition in which either the length of eye or power of cornea/lens is reduced resulting in image formation behind the retina. In Astigmatism, light rays from an object do not focus to a single point because

of variations in the curvature of the cornea or lens at different meridians. Astigmatism can be myopic or hyperopic [3].

It is estimated that approximately 40% of population in Pakistan is under 16yrs of age. Around 80,000 to 100,000 of children have low vision and among the most common presenting eyes problem reported are refractive error (41.45%), while hyperopia with accommodative esotropia was reported in 26.5% predominantly in males, Myopia and Astigmatism was seen in 15% [4, 5]. Hyperopia leads to accommodative esotropia in children. Association of myopia with exotropia has been reported previously [6, 7]. Strabismus is identified to be mainly because of hypermetropia. Children who were having hypermetropia of more than +3.25D to less than 5D show greater proportion of strabismus (17.0% vs 2.2%) in comparison to those without hyperopia. Another study reported an increased prevalence of strabismus among children with

moderate hyperopia [8]. Astigmatism has been observed to be associated with both the exotropia and the esotropia [7].

A thorough literature search (pubmed, Scientific reports volume, Cochrane database of systemic reviews) yielded no results for any specific study related to the frequency and nature of strabismus in children in Pakistani population. Very little is known about the different types of refractive errors in children with strabismus.

1.1. Squinting Eyes

It is also known as strabismus, and is a condition where the eyes do not look in the same gaze.

1.2. Refractive Errors

It will be considered positive on the presence of any one of the following groups based on spherical equivalent (SE) refractive error using snellen's chart for children

- 1) Myopia ($\leq 0.5D$).
- 2) Hypermetropia ($\geq +0.5D$).
- 3) Astigmatism (difference between the power of vertical and horizontal Meridians $\geq 0.5D$).

2. Objective

To find out refractive errors in children with strabismus in a tertiary care hospital.

3. Materials and Methods

3.1. Settings

Pediatric Ophthalmology, Hayatabad Medical Complex, Peshawar.

3.2. Duration

15th Sep 2021 to 15th Oct, 2021.

3.3. Study Design

Descriptive cross sectional prospective study.

3.4. Sample Size

Sample size was 146 keeping 41.45% proportion of refractive errors in children with squinting eyes, 95% confidence interval and 8% margin of error under WHO sample size calculations.

3.5. Sampling Technique

Non-probability consecutive sampling.

3.6. Sample Selection

3.6.1. Inclusion Criteria

- 1) All children presenting with squinting eyes (as per operation definition).
- 2) All the children in age range 4 to 16 years.
- 3) Both gender.

3.6.2. Exclusion Criteria

Patients with ocular co morbidities that makes refraction difficult.

The above mentioned conditions act as confounders and if included will introduce bias in the study results.

3.7. Data Collection Procedure

This study conducted after taking approval from hospital ethical and research committee. All the patients fulfilling the inclusion criteria were enrolled in the study through the Out Patient Department (OPD). The purpose and benefits of the study was explained to the patients and a written informed consent was taken.

The patient's age, gender, Visual Acuity, parent refractive error, early use of electric equipment were recorded in a proforma. Visual Acuity (VA) recorded at presentation using standard retro illuminated Snellen chart designed for children.

All refractive errors recorded and subjective refraction done to detect myopia, hypermetropia and amblyopia.. Refractive errors considered positive on the presence of any one of the following groups if myopia ($\leq 0.5D$), hypermetropia ($\geq +0.5D$), astigmatism (difference between the power of vertical and horizontal Meridians $\geq 0.5D$).

3.8. Data Analysis

The data analyzed by means of SPSS software (version 19). Mean + SD calculated for numerical variables like age. Frequencies and percentages calculated for gender and refractive errors (myopia, hypermetropia and Astigmatism). P value of ≤ 0.05 was taken as significant. All the results are recorded using tables.

4. Results

Mean age was 8.57 ± 2.66 years. Males were 89 (61.0%) and females were 57 (39.0%). Overall refractive error was present in 56 (38.4%) and was not present in 90 (61.6%) of patients (Table 1). Among them, Myopia was present in 9 (6.2%) and Hypermetropia was present in 32 (21.9%); furthermore; Astigmatism was present in 15 (10.3%) (Table 2). Parent refractive error was present in 37 (25.3%) and was absent in 109 (74.7%) (Table 4). Early use of electric equipment was obvious in 56 (38.4%) (Table 5).

Stratification of gender against the refractive error showed that of total 89 male 36 (40.4%) and 57 females 20 (35.1%) showed refractive errors. There was no significant association as the p value for this was 0.515.

Stratification of age against the refractive error showed that of total 78 patient with age equal or greater than 8 years 30 (39.5%) showed refractive errors. Moreover, 70 patients with age greater than 8 years, 26 (37.1%) showed refractive errors with p value 0.772.

Stratification of parent refractive error against the refractive error showed that of total 57 positive parent refractive error patients, 21 (36.8%) showed refractive errors. However, In 89 patients without parent refractive errors, 35 (39.3%) showed

refractive errors, p value 0.763.

Stratification of early used of electric equipment against the refractive error showed that of total 56 patients with early use of electric equipment, 24 (42.9%), showed refractive errors while the remaining 32 (57.1%) did not showed any refractive errors. In 90 patient without the early use of electric equipment, 32 (35.6%) showed refractive errors and 58 (64.4%) did not showed refractive errors, with p value 0.379.

Table 1. Demographic Characteristics of the Participants.

	Frequency	Percentage
Males	89	61.0%
Females	57	39.0%
Refractive Errors		
Yes	56	38.4%
No	90	61.6%
Age		
<8years	76	52.05%
>8 years	70	47.94%

Table 2. Frequency of different types of refractive errors.

Refractive errors	Frequency	Percentage
Myopia	9	(6.2%)
Hypermetropia	32	(21.9%)
Astigmatism	15	(10.3%)

Table 3. Frequency of refractive errors in different age groups.

		Refractive error		Total	P value
		Yes	No		
Age Group	<8 years	30	46	76	0.772
		39.5%	60.5%	100.0%	
	>8 years	26	44	70	
		37.1%	62.9%	100.0%	
Total		56	90	146	
		38.4%	61.6%	100.0%	

Table 4. Frequency of refractive errors in Parents.

		Refractive error		Total	P value
		Yes	No		
Parent refractive error	Yes	21	36	57	0.763
		36.8%	63.2%	100.0%	
	No	35	54	89	
		39.3%	60.7%	100.0%	
Total		56	90	146	
		38.4%	61.6%	100.0%	

Table 5. Effect of early use of electric equipment on refraction.

		Refractive error		Total	P value
		Yes	No		
Early use of electric equipment	Yes	24	32	56	0.379
		42.9%	57.1%	100.0%	
	No	32	58	90	
		35.6%	64.4%	100.0%	
Total		56	90	146	
		38.4%	61.6%	100.0%	

5. Discussion

There is limited literature available about refractive errors in patients with strabismus, however, there are studies available that shows prevalence of refractive errors in children.

Refractive error is the leading cause of correctable visual impairment, and the costs associated with its correction presents significant economic concerns.

Although this study found refractive error in 36 males and 20 females with a p value of 0.5, the difference between age and genders was not statistically significant. However, a study reported that overall prevalence of refractive errors among school children was higher among girls than boys (73.1% vs. 55.6%, $P=0.001$), but there is no significant difference in different age groups ($P=0.790$) [9, 10].

Refractive error was present only in 56 (38.4%) participant in this study, similar to a study done by Abady NH, Al-jumaili AA, Fayyadh RA, showed no relation between strabismus and anisometropia [11]. However, another study found a significant association between refractive error and Heterotropia (p value 0.000) [12].

Myopia was the least reported refractive error, 9 (6.2%) participants, in contrast to a meta analysis that showed lowest prevalence of myopia in South-East Asia, and the highest in the Western Pacific region [13].

Hypermetropia was most common refractive error present in squinting eye and was 32 (21.9%). Similarly, Schaal et al, in a strabismus study, found hyperopia as most prevalent error [14].

Although this study recorded astigmatism in 10.3% of the participant, a study published in 2018 showed astigmatism frequently present in patients presented to eye OPD with squint [15]. In addition, another study also stated astigmatism as the most common cause of strabismus and amblyopia among children [16].

Total 57 parent had refractive error patients, of whom, 21 (36.8%) children showed refractive errors. In 89 patients without parent refractive errors, 35 (39.3%) children had refractive errors. There was no significant association as the p value for this was 0.763. Contrarily, frequency of myopia and high myopia in children increased significantly to 1.37 (95% CI 1.04–1.81) and 11.41 (95% CI 6.24–20.88), as the degree of parental myopia increased (p < 0.001, respectively) [17]. Myopia in children with two myopic parents was more compared to those with one myopic parent (p < 0.001, respectively) [18].

This study showed no statistical difference in children with refractive error in comparison to those who did not. Nevertheless, a cross sectional study published in BMC ophthalmology found that eyeglass prescription frequently changed who used electronic gadgets [19].

Further data regarding these factors are very scanty.

6. Limitations

The specific population related to our hospital was included so can be generalized to our whole country. Furthermore, the observation bias in the diagnosis of these disease during examination or history cannot be neglected.

7. Conclusion

Prevalence of refractive errors is high in patient with strabismus. There is no association of age, gender, parent

refractive errors or early usage of electric equipment in the occurrence of refractive errors. Further studies are recommended for confirmation of these.

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