Ocular disorder among students with hearing impairment at a special education complex.

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ABSTRACT

Purpose: To investigate the ocular disorders among students with hearing impairment at a special education complex.

Methodology: This cross-sectional study was conducted from October 2021 to April 2022 at a Special Education Complex, Peshawar, Pakistan, following ethical approval from the research and ethics committee of the Pakistan Institute of Community Ophthalmology. All students with hearing impairments (HI) in a special education complex were included. The history regarding HI was taken from the school records. Visual acuity, anterior segment examination, and refraction were performed on each student. Chi-square and Pearson correlation were conducted using SPSS software.

Result: Out of 156 students, 120 (76.90%) were male. The mean age was 16 ± 4.47 years. Based on the school record, 121 (77.6%) students had congenital HI, and 35 (22.4%) had acquired HI. According to the severity of HI, 13 (8.3%) students had moderate, and 57 (36.5%) had severe HI. The ocular disorders were found in 57 (36.5%) students. Anterior segment pathologies were present in 55 (35.3%) students. Refractive error was found in 47(30.1%) students, heterophoria in 64 (41%) and amblyopia in 12 (7.7%). Ocular disorders were more common in children with profound HI. The association between ocular disorders and the severity of HI was not statistically significant. Twenty-three (14.7%) participants were referred for further detailed ophthalmological examination.

Conclusion: Ocular problems are more common in people with HI. Screening for ocular disorders and their management plays an important role in enhancing the quality of vision in hearing-impaired children to compensate for the poor auditory sense.

Keywords: Hearing impairment, ocular disorders, Amblyopia, refractive error, strabismus.

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INTRODUCTION

Sense of vision and hearing are crucial for learning. Deaf children rely heavily on vision to develop efficient communication skills and explore the world around them. Around 466 million people worldwide have a hearing impairment (HI). By 2050, 2·45 billion people will have HI–. In Pakistan, there are approximately 10 million people with HI. Ocular problems are common in people with HI. . Such disorders may be treatable, and their early identification is important for language development and social cognition.

Children with HI communicate through sign language and good-quality vision is important for interpreting the visual cues for learning. Any ophthalmic disorder may thus negatively impact this process, especially if it is unrecognized early in life. It has been demonstrated that deaf and hearing-impaired children are two to three times more likely to have ophthalmic abnormalities when compared to their normal-hearing peers. Deaf children with visual disorders may require multiple environmental adaptations. The collective consequence of deafness and vision disorder is greater on their functional independence than a single sensory impairment alone. Childhood blindness and visual impairment in developing countries remains a significant public health problem with an estimated 1.4 million blind children below the age of 15 years. The early detection of these disorders is of the utmost importance to optimize language development, spoken or signed, or both, and develop social cognition.

Studies have reported a high incidence of ophthalmic abnormalities (40%-62%) among deaf children when compared to normal-hearing children of the same age.. The most common disorders seen in these children are amblyopia, refractive errors and strabismus.

Although the nature and prevalence of ocular problems vary globally, there is a well-established correlation between deafness and eye issues. The purpose of this study was to look at the ocular conditions that affect hearing-impaired children in a special education facility in Peshawar, Pakistan.

METHODOLOGY

This cross-sectional study was conducted from October 2021 to April 2022 in a public-sector special school for hearing-impaired (HI) children in the district of Peshawar. Ethical approval was obtained from the research committee of the Pakistan Institute of Community Ophthalmology and permission was granted from the authorities of the special education complex to conduct this research. The study was conducted in accordance with the Declaration of Helsinki.

The study included all male and female students with hearing impairments in the age range of nine to twenty-three. Those students with HI who were uncooperative, absent on the day of the screening, or unwilling to participate were excluded from the study.

Students with spherical equivalent (S.E.) refractive error ≤ -0.5 diopters were considered myopic, and for S.E. more than or equal to ≥+1.00 diopters were considered hyperopic; cylindrical power -/+0.75 DC or more was considered astigmatic. The difference in refractive error of both eyes of ± 0.75 diopters was considered anisometropia.

All the parents were informed about the study one week before the survey with a letter including a return slip to express their willingness or denial of the students to be enrolled in the study. Informed consent was received from all parents. Before commencing the study, the examination procedure was explained to the principal and teaching staff. Participants with HI were briefed about the examination procedure with the help of their teachers and were asked if they were willing to undergo the ocular examination procedure through non-verbal sign language. Data was collected on a pre-designed pro forma.

The basics demographics of the students and the grading of HI were recorded from the available records in the administration section of the special

education complex. The classification of deafness in the better ear was done as per WHO classification.

Visual acuity assessment was performed using a Snellen acuity chart at 6 m in a well-illuminated room. Visual acuity was recorded in both eyes, followed by the right and left eye. In cases of visual acuity worse than 6/9, visual acuity was assessed with a pinhole to differentiate the refractive error from other pathologies. Objective refraction was performed using streak retinoscopy on the participant whose visual acuity improved with a pinhole. Subjective refraction was also performed for the final prescription.

Ocular alignment was assessed using a Hirschberg light reflex and cover test at 6 m followed then at 40 cm with and without the accommodative target. The extraocular muscle motility was evaluated with the target and recorded. All the abnormal findings were documented on the proforma.

Anterior segment examination was performed using a pen torch and magnifying loup to rule out any abnormalities of the eyelids, conjunctiva, cornea, anterior chamber, iris, and lens. For the posterior segment, any abnormal reflex on direct ophthalmoscopy and/or those who were not improved with a pinhole were referred to a tertiary hospital for a detailed examination by an ophthalmologist.

The collected data was entered and analyzed through the Statistical Package for Social Sciences (SPSS) version 2022. The data was expressed using descriptive statistics.

RESULTS

Among the total 156 participants with hearing impairment, 120 (76.90%) were male. Mean age was 16.00 ± 04.47 years. Most of the participants were in the middle level of education (n = 64;40.90%). The school records about hearing impairment of students showed that 121 (77.6%) students had congenital hearing loss and 35 (22.4%) had acquired hearing loss. According to the severity of hearing impairment, 13 (8.3%) students had moderate hearing loss, and 57 (36.5%) had severe hearing impairment. There were 86 (55.1%) students with profound hearing loss. A total of 98 (62.8%) students were having a positive family history of HI. Details are shown in Table 1.

Table 1. Demographic profile of the participants

Characteristics of the participants		Gender		Total
		Boys	Girls	n (%)
		n (%)	n (%)	
Age range	09-13 years	26 (16.70)	15 (09.60)	41 (26.30)
	14-18 years	65 (41.70)	13 (08.30)	78 (50.00)
	19-23 years	29 (18.60)	08 (05.10)	37 (23.70)
Education level	Primary level	32 (20.00)	12 (07.68)	44 (28.14)
	Middle level	50 (31.90)	14 (08.96)	64 (40.90)
	Secondary level	38 (24.35)	10 (06.40)	48 (30.72)
Types of hearing impairment	Congenital	90 (57.7)	31 (19.9)	121 (77.6)
	Acquired	30 (19.2)	05 (03.2)	35 (22.4)
Level of severity of hearing impairment	Moderate	11 (07.1)	02 (01.3)	13 (08.4)
	Severe	41 (26.3)	16 (10.3)	57 (36.6)
	Profound	68 (43.6)	18 (11.5)	86 (55.1)
Possitive family history of hearing impairment		76 (48.7)	22 (14.1)	98 (62.8)

Among the participants, 117 (75%) and 110 (75%) had a baseline VA of 6/6 in the right eye and left eye, respectively and 120 (77%) of students had binocular VA of 6/6. One participant had binocular VA of less than 6/60. Table 2 shows uncorrected visual acuity of the right eye and left eye separately and binocularly.

Table 2. Uncorrected and corrected visual acuity status of the participants

	Uncorrected Visual Acuity			Best-corrected Visual Acuity		
Visual impairment	**OD**	**OS**	**OU**	**OD**	**OS**	**OU**
	n (%)	**n (%)**				
6/6 or better	117 (75.0)	110 (70.5)	120 (77.0)	122 (78.2)	117 (75.0)	125 (80.12)
<6/6 to 6/9	27 (17.3)	29 (18.6)	29 (18.6)	27 (17.3)	30 (19.23)	23 (14.74)
<6/9 to 6/12	02 (01.3)	05 (03.2)	04 (02.6)	02 (01.3)	04 (02.6)	03 (01.9)
<6/12 to 6/18	04 (02.6)	04 (02.6)	03 (01.9)	01 (00.6)	0	03 (01.9)
<6/18 to 6/60	04 (02.6)	06 (03.8)	02 (01.3)	04 (02.6)	05 (03.20)	02 (01.3)
<6/60	02 (01.3)	02 (01.3)	01 (0.60)	0	0	0

Myopia was the major refractive error found in 25 (16.0%) students. Among the 64 students with phoria, exophoria was common with 41 (26.2%) students. Regarding anterior segment anomalies, blepharitis was a common finding at the time of examination. Twenty-three students (14.7%) were referred for further ophthalmic examination including posterior segment examination. Details about the refractive status and anterior segment pathologies of the students present at the time of examination are given in Table 3.

Table 3. Ocular morbities of participants

Ocular morbidities		**Gender**		**Total**
		Boys	**Girls**	**n (%)**
		n (%)	**n (%)**	
Refractive error	Myope	11(7.1)	08(5.1)	19(12.2)
	Hyperopia	07(4.5)	03(1.9)	10(6.4)
	Astigmatism	13(8.3)	04(2.6)	17(10.9)
	Anisometropia	04(2.6)	02(1.3)	06(3.9)
Heterophoria	Esophoria	09(5.8)	07(4.5)	16(10.3)
	Exophoria	34(21.8)	07(4.5)	41(26.3)
	Vertical phoria	07(4.4)	0	07(4.4)
Heterotopia	Esotropia	03(1.9)	01(0.6)	04(2.6)
	Exotropia	02(1.3)	01(0.6)	03(1.9)
	Vertical tropia	04(2.6)	01(0.6)	04(2.5)
Anterior segment anomalies	Blepharitis	32(20.5)	09(5.8)	41(26.3)
	Conjunctivitis	07(4.5)	01(0.6)	08(5.1)
	Ptyregium	01(0.6)	0	01(0.6)
	Media opacity	02(1.3)	0	02(1.3)
	Heterochromia	01(0.60)	0	01(0.6)
	Ptosis	01(0.60)	01(2.8)	02(3.4)
Amblyopia		08(5.1)	04(2.6)	12(7.7)
Refferd		17(10.90)	06(3.8)	23(14.7)

Myopia was found to be high (12.2%) in students followed by astigmatism 10 (6.4%). Myopia was most common in children with profound HI (8.3%). Fisher's Exact Test was used to find the association between each ocular condition (e.g., Heterophoria, amblyopia) and hearing loss severity (mild/moderate/severe). The frequency of amblyopia, anisometropia, phoria, and tropia was high in students with profound hearing loss, however, the difference was not statistically significant. The anterior segment pathologies present during the examination were also high in students with profound hearing loss. Table 4 shows the comparison of ocular disorders with levels of severity of HI in subjects.

Table 4. Ocular morbidities with severity of hearing loss.

Ocular Morbidities		**Level of hearing loss**				
		Moderate	**Sever**	**Profound**	**Total**	**P value**
		n (%)	**n (%)**	**n (%)**	**n (%)**	
Refractive Error	Myope	03(1.9)	11(7.1)	13(8.3)	19 (12.2)	0.542
	Hyperope	0	4(2.6)	8(5.1)	10 (6.40)	0.542
	Astigmatism	0	10(6.4)	9(5.8)	17 (10.9)	0.168
	Anisometropia	0	2(1.3)	4(2.6)	6 (3.90)	0.709
Hetero-phoria	Esophoria	3(1.9)	4(2.6)	9(5.8)	16 (10.3)	0.151
	Exophoria	4(2.6)	11(7.1)	26(16.6)	41 (26.3)	
	Vertical phoria	0	3(1.90)	4(2.6)	7 (4.40)	
Hetero-topia	Esotropia	0	1(0.6)	3(1.9)	4 (2.60)	
	Exotropia	0	1(0.6)	2(1.3)	3 (1.90)	
	Vertical tropia	0	2(1.30)	2(1.3)	4 (02.50)	
Anterior segment anomalies	Blepharitis	2(1.30)	14 (9.0)	25(16.00)	41 (26.3)	0.234
	Conjunctivi-tis	0	5(3.20)	3(1.9)	8(5.10)	
	Ptyregium	0	0	1(0.60)	1(0.60)	
	Media opacity	0	1(0.60)	1(0.6)	2(1.30)	
	Heterochromia	0	1(0.60)	0	1(0.60)	
	Ptosis	0	2(1.30)	0	2(3.40)	
Amblyopia		1(0.6)	4(2.6)	7(4.5)	12 (07.0)	0.151

DISCUSSION

Findings from this study demonstrate that the most common cause of hearing impairment (HI) in the students was congenital and more than half (55.1%) of the students had profound HI. Male students were dominant among our participants. About one-third

(36.5%) of the students had some ocular abnormality. Phoria was the most common ocular disorder, followed by refractive error. Blepharitis was the most common anterior segment ocular problem and was found in one-fourth of the students (26.3%).

Congenital HI was found in three-fourths (77.6%) of students, and 22.4% had acquired HI. A study from Turkey reported congenital HI in 83% and acquired HI in 17%. Another study conducted in Tehran reported 89.9% with congenital HI. Consistent with these studies, our study also shows that the prevalence of congenital HI is high in these children. The prevalence of profound HI in our participants was high (52.1%) as reported in a study conducted in India (52.8%). About three-fourths (76.9%) of students in our study were male. This male dominance could be due to low literacy in females in our country. Similar to our study, a study from Mexico reported that 70.8% of students were male.

Literature reported ophthalmic problems in 40% to 62% of children with HI. Results from our study show that 36.5% of students had some ocular abnormality. These results are similar to a study conducted in Turkey that reported 36% had ocular disorders. A study from Nigeria reported that 20.9% of students with HI had an ocular abnormality. That study reported anterior segment abnormalities such as allergic conjunctivitis in 3.4% of students with HI. Another study from Ghana reported anterior segment abnormalities in 11.1%. In our study, anterior segment anomalies were found in 55 (35.2%) students with blepharitis as the most common (26.3%), followed by conjunctivitis (5.1%). The higher number of anterior segment abnormalities in our study could because anterior segment abnormalities are much greater in the spring season from February to April in our country.

Refractive error was the second most common ocular disorder found in 30.1% of students, which is comparable to the 31.9% reported by a study conducted in the region of Ghana to determine visual impairment and ocular findings among deaf and hearing-impaired school children. These results were also consistent with findings from a study conducted in Turkey that investigated the nature and prevalence of ocular abnormalities, which reported refractive error in 29.8% of participants . A study conducted in Iran reported that 40.5% of students with HI had refractive errors. Another study from Nigeria reported a lower number of refractive errors (7.9%) in students with HI; however, that study reported refractive the errors as most common ocular abnormality in these students.

In our results, myopia was the leading refractive anomaly (n=27; 17.3%) found in students, which is supported by other studies conducted in different regions. Some studies reported astigmatism , and other hyperopia as the leading refractive anomaly. However in our study, hyperopia was found to be 12 (7.7%) and astigmatism was present in 19 (12.2%) of students.

The majority of the studies reported different frequencies of manifest and latent strabismus. In our study, manifest strabismus was present in 10 (6.4%) students, with esotropia as the most common (2.6%). Among the participants in our study, phoria was present in 64 (41%) students, with exophoria the most common (n = 41; 26.3%) followed by esophoria (n = 16;10.3%), and vertical phoria in 4.4%. Similar to the results of our study, a study from Tehran reported exophoria in 20.3%. A study from Ghana reported a higher frequency of exophoria (78%) followed by esophoria (8%).

This study shows that ocular abnormalities such as anterior segment anomalies and refractive errors were not associated with the type and severity of hearing loss. In contrast, studies from Tehran and Columbus reported an increased prevalence of ocular abnormalities in children with severe HI. Consistent with results from our study, the prevalence of ocular disorders was found to be significantly increased in children with HI from the general population.

Conclusion: Ocular problems are more common in people having hearing impairment than normal. Screening for ocular problems and their management plays an important role in enhancing the quality of vision in hearing-impaired children to compensate for the poor auditory sense.

Conflict Of Interest: None to declare

Ethical Approval: The study was approved by the Institutional Review Board / Ethical Review Board Reference No. 3291/PGS/PICO/2021 dated 07.09.2021, Pakistan Institute of Community Ophthalmology, Peshawar Pakistan.

Authors' Contributions:

Shazia Noreen: Concept, Design, Literature research, Data acquisition, Data analysis, Statistical analysis, Manuscript preparation, Manuscript editing, Manuscript review.

Mufarriq Shah: Concept, Design, Literature research, Data acquisition, Data analysis, Statistical analysis, Manuscript preparation, Manuscript editing, Manuscript review.

Afaf Johar: Concept, Design, Literature research, Data acquisition, Data analysis, Statistical analysis, Manuscript preparation, Manuscript editing, Manuscript review.

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