

Ocular Manifestations in Children with Academic Difficulties

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ABSTRACT

Introduction: To study and treat ocular disorders in children with academic difficulties referred from the learning disability clinic.

Materials and methods: Children with academic difficulties were referred to the Learning disability clinic and ophthalmology department in a period of 18 months. The medical histories, distant vision using Lea symbols or Snellen's chart and examination including ocular motility, accommodative capacity, convergence, near vision, anterior and posterior segment examination were performed. Orthoptic exercises for convergence insufficiency, glasses for refractive errors, amblyopia treatment and surgical treatment for squint were instituted.

Results: In a total of 176 students (6-16 years) examined; 118 (67%) were male, 58 were females (33%), 64 children had refractive error (36.3%). Out of 64, 16 children (25%) had an uncorrected refractive error, 48 (75%) were previously diagnosed refractive error, wearing spectacles. Strabismus in 16 children (9%), nystagmus in 4 (2.3%), amblyopia in 18 (10.20%), convergence insufficiency in 14 (7.9%), optic atrophy in 1 (0.5%), retinal dystrophy and congenital anomaly in 3 (1.7%).

Conclusion: Nearly half the children with academic difficulties in this study had ocular disorders and one-third were offered treatment for their vision improvement. A complete ophthalmic examination is mandatory in all children of school age group for early detection of ocular disorders.

Keywords: Academic difficulties, Learning disability clinic, Ocular manifestations.

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INTRODUCTION

Education plays an extremely important role in human resource development. Poor scholastic performance can have a detrimental effect on the overall development of a child and also causes significant stress on the parents, leading to a variety of psychosocial problems.

Recognition of the causes of poor school performance as well as effective remedial measures are extremely important. There are many reasons for a child to underperform academically in school, the important ones being *medical problems* that include preterm birth and low birth weight, malnutrition and nutritional deficiencies, hearing impairment, visual impairment, asthma and allergic rhinitis, neurological problems, some chronic diseases like thalassemia, juvenile rheumatoid arthritis, etc., and *neurobehavioral disorders* that include specific learning disorders, attention deficit hyperactive disorder, and autism.

In the process of finding the etiological basis of the academic difficulties faced by these children, it is extremely essential to rule out medical causes of which visual morbidities form a significant part. It is extremely important to find out the cause(s) for a child's poor school performances and come up with a treatment plan early so that the child can perform up to full potential.¹ There have been only two studies of ocular disorders in children with academic difficulties from India, which show that ophthalmic conditions, such as refractive errors, strabismus, and nystagmus are common.²

The aim of this study was to find the prevalence of ophthalmic manifestations in children with academic difficulties and to find out the causes of treatable and reversible vision loss and plan appropriate intervention.

MATERIALS AND METHODS

It was a prospective, noncomparative, observational cohort study in a tertiary health care center. The study was carried out for a period 18 months. Children with academic difficulties attending the Ophthalmology Outpatient Department referred from the Learning Disability Clinic (LDC) were included in the study. A total of 176 children referred from LDC with academic difficulties were enrolled. All children in the age group of 6 to 16 years with academic difficulties referred from the LDC were included.

Exclusion criteria were children with severe mental retardation, children who did not cooperate for the examination, children whose parents were not able to give sufficient information pertaining to the condition, or the child was less than 6 years or more than 16 years of age.

The study was approved by the Ethics Committee for research on human subjects of the institute. After informing the study procedure, written informed consent was

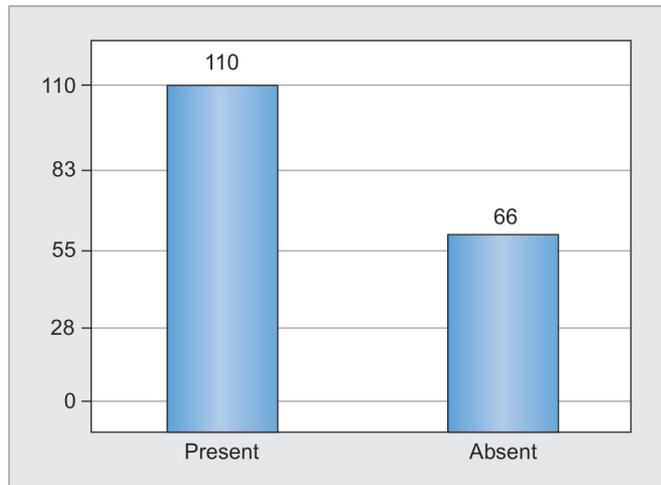
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Table 1: Ocular manifestations

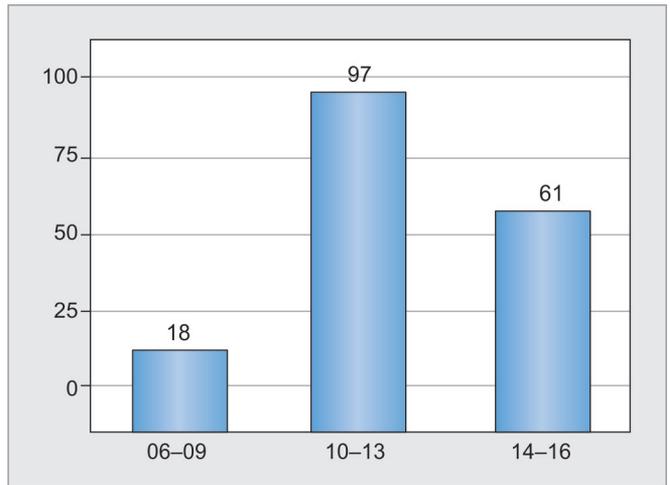
Ocular manifestation	No. of children	%
Present	110	62.50
Absent	66	37.50
Total	176	



Graph 1: Ocular manifestations

Table 2: Age distribution of children with academic difficulties

Age (years)	No. of children	%
6–9	18	10.20
10–13	97	55.10
14–16	61	34.60
Total	176	



Graph 2: Age distribution of children with academic difficulties

taken from parents or caretakers of patients. The parents/ caretakers were briefly interviewed to obtain detailed history of each child. This was followed by an ophthalmic evaluation, which included the vision, orthoptic evaluation, extraocular motility, anterior segment evaluation, and posterior segment evaluation. All children included were tested for vision with Snellen’s optotype at 6 m. Near vision was tested with Jaeger’s near vision chart at 14 inches.

All patients underwent cycloplegic refraction with cyclopentolate (1%) or homatropine (2%) instilled at 5 minute intervals three times alternated with tropicamide (0.8%), and refraction was done after 40 minutes.

Tropicamide (0.8%) was used for children above 8 years. Atropine sulfate (1%) was used for children with squint. Any significant refractive error was treated with glasses. Amblyopia was treated with glasses with/ without patching. Squint patients were advised surgery after optimum optical correction and occlusion therapy.

RESULTS AND OBSERVATIONS

Out of the 176 children referred from LDC with academic difficulties, 110 children (62.5%) had one or more ocular manifestations.

The various academic difficulties noted were:

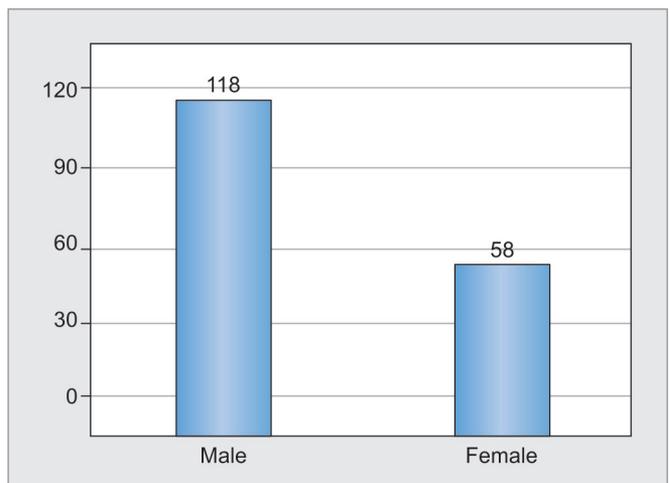
- Difficulty in reading
- Difficulty in writing
- Difficulty in calculations
- Difficulty in articulation of words

These manifestations were highly overlapping in the children referred from school (Table 1 and Graph 1).

Out of the 176 children with academic difficulties, 18 children (10.2%) were from the age group of 6 to 9 years; 97 children (55.1%) were from the age group of 10 to 13 years; 61 children (34.6%) were from the age group of 14 to 16 years (Table 2 and Graph 2). Out of them, 118 (67%) were males and 58 (33%) were females (Table 3 and Graph 3).

Table 3: Sex distribution of children with academic difficulties

Sex	No. of children	%
Male	118	67.00
Female	58	33.00
Total	176	



Graph 3: Sex distribution of children with academic difficulties

Table 4: Right eye vision

LogMAR units	No. of children	%
0–0.3 (20/20 to 20/40)	153	86.90
0.4–1 (20/50 to 20/200)	19	10.80
>1 (>20/200)	4	2.30
Total	176	

Table 5: Left eye vision

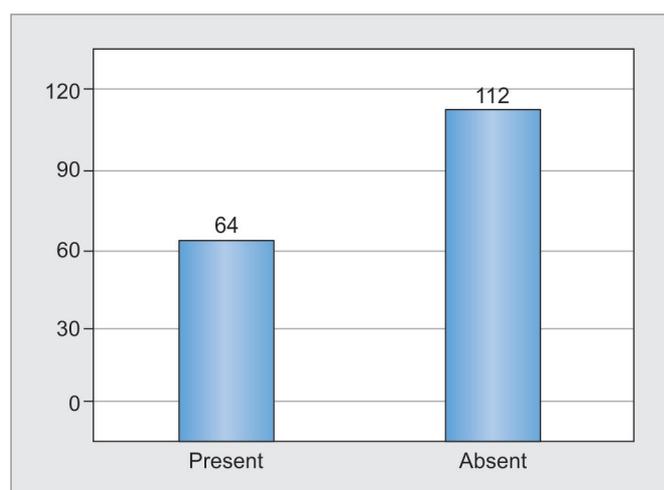
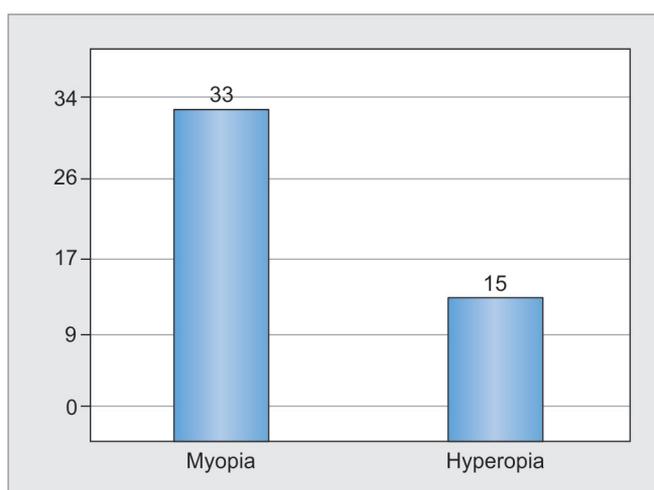
LogMAR units	No. of children	%
0–0.3 (20/20 to 20/40)	153	86.90
0.4–1 (20/50 to 20/200)	18	10.20
>1 (>20/200)	5	2.90
Total	176	

Table 6: Refractive error

Refractive error	No. of children	%
Present	64	36.30
Absent	112	63.60
Total	176	

Table 7: Refractive error

Type of refractive error	No. of children	%
Myopia	33	68.80
Hyperopia	15	31.20
Total	48	

**Graph 4:** Refractive error**Graph 5:** Type of refractive error

In the right eye, 153 children out of 176 (86.9%) who had academic difficulties had vision of 0 to 0.3 logMAR units (Snellen's chart: 20/20 to 20/40); 19 children out of 176 (10.8%) with academic difficulties had vision of 0.4 to 1 logMAR units (Snellen's chart: 20/50 to 20/200); 4 children out of 176 (2.3%) with academic difficulties had vision of >1 logMAR units (Snellen's chart: >20/200; Table 4).

In the left eye, 153 out of 176 (86.9%) children who had academic difficulties had vision of 0 to 0.3 logMAR units (Snellen's chart: 20/20 to 20/40); 18 children out of 176 (10.2%) with academic difficulties had vision of 0.4 to 1 logMAR units (Snellen's chart: 20/50 to 20/200); 5 children out of 176 (2.9%) with academic difficulties had vision of >1 logMAR units (Snellen's chart: >20/200; Table 5).

Refractive errors were present in 64 (36.3%) out of the 176 children with academic difficulties. Out of those 64 children, 48 children (75%) were wearing spectacles, while 16 children (25%) were undiagnosed cases of refractive error (Table 6 and Graph 4).

Out of the total of 48 children with academic difficulties who were wearing glasses, 34 children out of 48 (70.8%) were advised to continue the same prescription, while 14 children (29.2%) were advised to change their glasses.

Out of the 64 children who had academic difficulties with refractive error, 15 children (23.4%) had purely cylindrical correction, 22 children (34.3%) had spherical correction and 27 children (42.1%) had a combination of spherical and cylindrical correction (Table 7 and Graph 5).

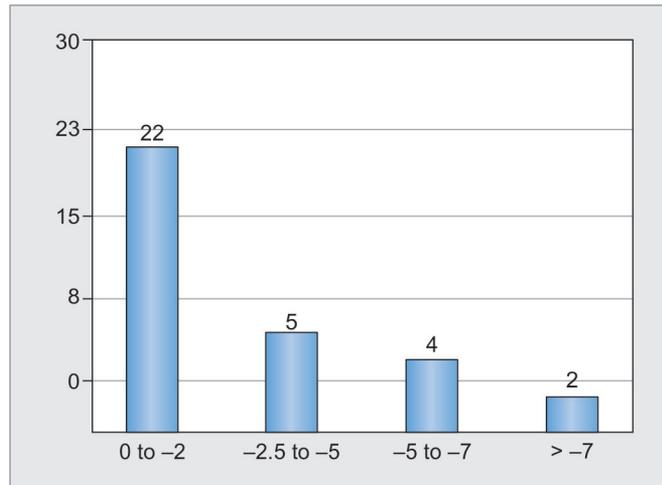
Thirty-three children with academic difficulties had myopia and 15 children had hyperopia. Out of the 33 patients with academic difficulties who had myopia, 22 (66.7%) had a refractive error of less than -2D; 5 children (15.1%) had refractive error of -2.5D to -5D; 4 children had myopia with refractive error between -5D and -7D; 2 children had high myopia with refractive error of more than -7D (Table 8 and Graph 6).

Total of 11 children with academic difficulties had hyperopia in the range of +1D to +3D; 4 children had hyperopia of more than +3D (Table 9 and Graph 7).

In the distribution of ocular manifestations, a total of 18 children with academic difficulties had amblyopia. A total of 14 children (7.9%) with academic difficulties had convergence insufficiency; 7 children (3.9%) with academic difficulties had ocular motility restriction (Table 10 and Graph 8).

Table 8: Distribution of myopia

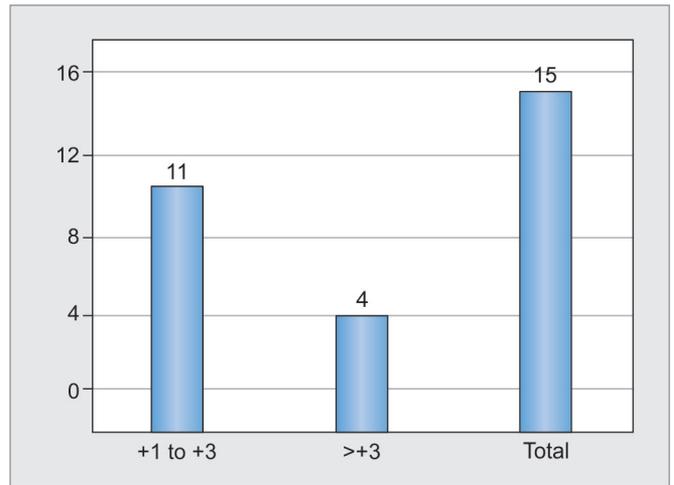
Myopia (Diopters)	No. of children	%
0 to -2	22	66.70
-2.5 to -5	5	15.20
-5 to -7	4	12.10
>-7	2	6.10
Total	33	



Graph 6: Distribution of myopia

Table 9: Distribution of hyperopia

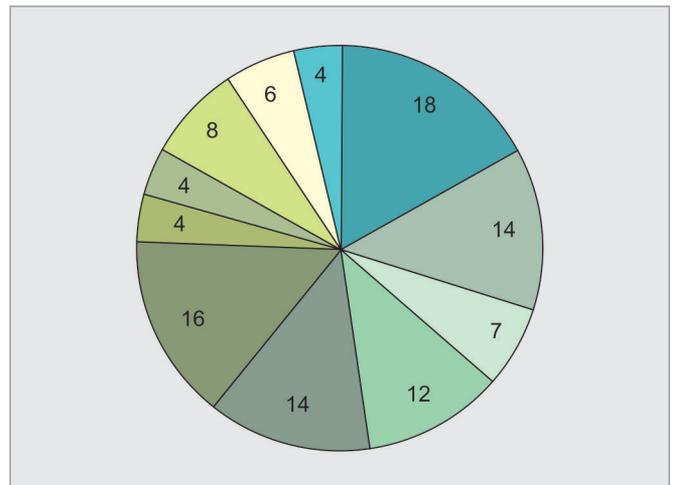
Hyperopia (Diopters)	No. of children	%
+1 to +3	11	73.30
>+3	4	26.70
Total	15	



Graph 7: Distribution of hyperopia

Table 10: Ocular manifestations

Ocular manifestation	No. of children	%
Amblyopia	18	10.20
Convergence insufficiency	14	7.90
Ocular motility restrictions	7	3.90
Anterior segment abnormality	12	6.80
Corneal opacities	5	
Keratoconus	2	
Iris coloboma	3	
Chronic anterior uveitis	1	
Neurofibromatosis	1	
Posterior segment abnormality	14	7.90
Temporal pallor	6	
Myopic degeneration of fundus	4	
Choroidal coloboma	2	
Optic atrophy	1	
Retinitis pigmentosa	1	
Squint	16	9.00
Exotropia	7	
Esotropia	9	
Astereopsis	4	2.30
Nystagmus	4	2.30
Blepharitis	8	4.50
Allergic conjunctivitis	6	3.40
Chalazion	4	2.30
Total	107	



Graph 8: Ocular manifestations

A total of 12 children (6.8%) with academic difficulties had anterior segment abnormality; 5 children had nebulomacular opacities; 3 children had iris coloboma; 2 children had keratoconus; 1 child had chronic anterior uveitis; 1 child had neurofibromatosis.

A total of 14 (7.9%) children with academic difficulties had posterior segment abnormalities; 6 children had temporal disk pallor, 4 children had myopic degeneration of fundus; 2 children had choroidal coloboma; 1 child had optic atrophy; 1 child had retinitis pigmentosa.

A total of 16 children (9%) with academic difficulties had squint; 7 children out of 16 (43.75%) with academic difficulties had exotropia and 9 children (62.25%) had esotropia; 4 children with academic difficulties had nystagmus (2.27%); 8 children (4.54%) had blepharitis. A total of 6 children (3.4%) with academic difficulties referred from LDC had allergic conjunctivitis.

DISCUSSION

Education is one of the most important aspects of human resource development. Poor school performance not only results in the child having a low self-esteem but also causes significant stress to the parents.

There are many reasons for children to underperform at school, such as medical problems, below average intelligence, specific learning disability, attention deficit hyperactivity disorder, emotional problems, poor socio-cultural home environment, psychiatric disorders, and even environmental causes.¹

Estimates of the prevalence of learning problems among school-aged children range from 2 to 10%, depending on the nature of the diagnostic process and the definitions applied by individual school districts.³

An analysis of the literature on the subject indicates that refractive error, in particular, hyperopia and significant anisometropia, accommodative and vergence dysfunctions, and eye movement disorders are associated with learning problems.³

Majority of the children in our study referred from the LDC with academic difficulties were males, i.e., 118 children out of 176 were males (67%). In another study of ocular disorders by Gogate et al⁴ in learning disability children, 61% children were males.

In our study, maximum children, 97 children (55.1%), were in the age group of 10 to 13 years presumably because of increased academic load.

In our study, 66 of the 176 children (37.5%) who had academic difficulties had no ocular findings. In 110 of the 176 children (62.5%), there were one or more ocular findings which is higher as compared with Kathmandu valley researchers where they reported that among the students aged 5 to 16 years, 34.2% had some form of ocular disorders.⁵

In our study refractive errors were found in 64 children (36%) with academic difficulties as compared with another study by Goldstand et al,⁶ where visual deficits were found in 68% of the participants with academic difficulties and significantly more among boys than girls.

In our study, 33 children (51.5%) with refractive error had myopia and 15 children (23.5%) had hypermetropia. Refractive errors in boys were significantly more than girls. Out of the 64 children with refractive errors, 39 children were males and 25 children were females. Another significant finding in our study was that 42 children (65.6%) had either purely cylindrical or a combination of spherical and cylindrical refractive error.

Bankes et al found 49% mentally handicapped children had some form of refractive error.⁷ Warburg⁸ found the prevalence of myopia to be at 43% and of hypermetropia at 21% in severe/profoundly intellectually

impaired adults. The effects of uncorrected/poorly corrected hyperopia in children are educationally disadvantageous⁹ presumably because of difficulty in near work, excessive convergence and accommodation, leading to headache and higher incidence of amblyopia leading to loss of interest in studies. A study from Pokhara, Nepal, reported that 6.43% of schoolchildren aged 10 to 19 years had refractive errors. Myopia was found to be the most common (4.05%). More boys (7.59%) were found to have suffered from refractive errors than girls (5.31%).¹⁰

Among the schoolchildren aged 5 to 10 years in Kolkata, a study by Das et al showed that 25.11% children had refractive errors, myopia being the commonest (14.02%); astigmatism affected 3.93%.¹¹

In our study, 28 children (43.5%) with refractive error were either not using spectacles or were wearing spectacles with wrong prescription. These children needed active intervention in terms of new prescription or change of glasses; 36 children were wearing the correct prescription (56.5%). In a study of 664 students of special schools in Pune by Gogate et al,⁴ 238 (45.3%) had ocular disorder; 143 (27.3%) had an uncorrected refractive error; 103 children had more than one abnormality. Only 12 of the 143 students with refractive errors were using spectacles.

Ophthalmic tests on 105 children provided an accurate diagnosis of vision defects, with reference to their education scores. Around 50% of the children examined by optometrists required an intervention (prescription change, glasses prescribed, or referral).⁹

It was observed that 12 children out of 64 (18.75%) had uncorrected refractive error and never used glasses, which was higher as compared with Padhye et al, where the prevalence of uncorrected refractive error in urban schoolchildren was 5%. A study of primary schoolchildren between 6 and 14 years of age in the rural Tibetan area of Maqin County, China, reports that 18.36% had ocular morbidity. Refractive errors were found in 11.07%, strabismus in 2.49%, corneal leukemia in 1.20%, and amblyopia in 1.02%.¹²

A study on urban schoolchildren 5 to 15 years of age revealed that the prevalence of uncorrected, baseline (presenting), and best-corrected visual acuity of logMAR unit 0.3 (20/40 on Snellen's chart) or worse in the better eye was 6.4, 4.9, and 0.81% respectively. Refractive error was the cause in 81.7% of eyes with vision impairment, amblyopia in 4.4%, retinal disorders in 4.7%, other causes in 3.3%, and unexplained causes in the remaining 5.9%. There was an age-related shift in refractive error from hyperopia in young children (15.6% in 5-year-olds) toward myopia in older children (10.8% in 15-year-olds). Overall, hyperopia was present in 7.7% of children and myopia in 7.4%. This

study was done in a regular school and not particularly in children with academic difficulty.¹³

In our study, amblyopia was the second commonest association with 18 children (10.2%) with academic difficulties having amblyopia; 11 children (12.5%) with specific learning disabilities and 7 children (7.9%) with academic difficulties not associated with learning disability had amblyopia. These children were advised occlusion therapy depending on the age along with proper correction in the affected eye. Amblyopia has a significant effect on psychosocial functioning and warrants aggressive screening, prevention, and treatment during the amblyogenic years.

In one study by Packwood et al,¹⁴ a significant number of patients felt that amblyopia interfered with school (52%) and work (48%).

Convergence insufficiency is associated with poor academic performance.¹⁵ A total of 14 (7.9%) children with academic difficulties had convergence insufficiency. These children were advised home convergence/orthoptic exercises.¹⁶

In our study, 16 children (9%) with academic difficulties had squint and ocular motility disorders. They were advised optical/orthoptic/surgical treatment depending on the etiology. Optical correction was given for accommodative esotropia. The presence of squint has a psychological impact on the child which is a significant factor hampering academic progress.¹⁷

In our study, 7 out of 16 children (43.75%) with academic difficulties who had squint had exotropia, while 9 children had esotropia (62.25%). In a study of 1,100 schoolchildren from Nepal, strabismus was the second most common manifestation (1.6%).¹⁸ In a study by Matsuo and Matsuo¹⁹ of 86,321 pupils aged between 6 and 12 in Japanese elementary schools, 1.28 and 0.14% pupils had strabismus and amblyopia respectively.

In anterior segment abnormalities, 6 children (50%) had nebulomacular opacities, 3 children (25%) had iris coloboma, 2 children (16.6%) had keratoconus, and 1 child had chronic anterior uveitis (8.3%).

In posterior segment abnormalities, 6 children (42.8%) with academic difficulties had temporal pallor, 4 children (25%) had myopic degeneration of fundus, 2 children (16.6%) had optic nerve coloboma, 1 child (7.1%) had optic atrophy, and 1 child had retinitis pigmentosa (7.14%). In a study of 664 students of special schools in Pune by Gogate et al,⁴ strabismus was present in 83 (15.8%), nystagmus in 36 (6.8%), optic atrophy in 34 (6.5%), and congenital anomalies in 13 (2.5%); 103 children had more than one abnormality. While analyzing the data of our study, there were not enough studies in the literature that included visual manifestations in children with academic difficulties.

CONCLUSION

In our study, 110 children out of the 176 (62.5%) had one or more ocular manifestations. Out of the causes of reduced vision refractive error, squint convergence insufficiency, nystagmus, and amblyopia formed a major part, with 98 children (55.6%) having either of the one manifestations. Sixty-four children (36%) had some kind of refractive error. Out of these, 35 were diagnosed to have specific learning disability; 28 children out of these 64 children (43.75%) needed simple prescription of new glasses or change in the preexisting glass prescription, which would definitely help overcome visual handicap. Squint and nystagmus patients were treated by orthoptics, surgery, or glasses. Convergence exercises were advised to children with convergence insufficiency. Amblyopic children were advised patching of the better eye.

Majority of these causes of vision loss are completely treatable if intervened at an early age preventing academic difficulties in future and visual handicap. There are higher chances of amblyopia, difficulty in near work, convergence excess, and headache due to high uncorrected hyperopia. Such patients should be given spectacle correction at the earliest and appropriate treatment for amblyopia should be initiated. Our study highlights the importance of pre-school visual assessment/screening and regular assessment of vision, which should be made mandatory in each school (at least annually) since there are significant number of children who need timely intervention of such ocular morbidities, and if corrected on time, can contribute significantly in their academic achievements as majority of these causes of vision.

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