

Investigating Amblyopia and Its Risk Factors among School Children: An Observational Study

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Abstract:

Background and Aim: This study aimed to evaluate the prevalence of amblyopia and identify the factors that contribute to its development in school-aged children from the Visnagar region of Gujarat. Additionally, the study aimed to implement appropriate treatment methods based on the type of amblyopia and monitor the patients for any signs of improvement.

Material and Methods: This study was conducted at the Department of Ophthalmology in a Tertiary Care Teaching Institute in India. It involved observing 1000 school-going children over the course of one year. Every child attending school between the ages of 5 and 16 within a 3km radius of the Visnagar region in Gujarat was included in the study. There were a total of 25 cases of amblyopia that were detected and thoroughly studied. The patient's complaints were documented in the order they occurred, and a thorough history of their current illness was obtained.

Results: The most common risk factor associated with amblyopia was anisometropia, accounting for 53.33% of cases. A majority of patients experienced unilateral amblyopia, with a significant number falling into the moderate category. Out of the 25 amblyopic cases, a significant improvement in visual acuity of more than 2 Snellen lines was observed in 16 cases. The relationship between the length of occlusion therapy and visual improvement in children with amblyopia did not reach statistical significance ($p>0.05$).

Conclusion: Anisometropia was identified as the most common causative risk factor for amblyopia in relation to refractive error. Detecting and treating amblyopia at an early age is crucial for preventing long-term vision problems and minimising the risk of permanent vision loss.

Keywords: Amblyopia, Refractive Error, School Going Children, Visual Acuity.

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Introduction

Amblyopia is a significant issue that can cause lifelong visual impairment, making it a matter of great concern for public health. It's surprising how often amblyopia goes unnoticed, mainly because parents aren't always aware of refractive errors in children and don't seek visual screenings from ophthalmologists until later on. Amblyopia can be caused by various factors such as anisometropia, high refractive errors, opacities of the ocular media, strabismus, or a combination of multiple causes. [1-6]

There are several factors that can increase the risk of developing amblyopia. These include high refractive error, anisometropia, strabismus, unilateral or bilateral media opacity, congenital cataract, severe ptosis, prematurity, congenital glaucoma, persistent pupillary membrane, lens dislocation, persistent hyperplastic primary vitreous, low birth weight, maternal substance abuse, maternal gestational smoking, and low

parental education levels, as well as a lower socioeconomic background. [7]

According to Sachswenger, amblyopia is a leading cause of vision loss in individuals under the age of 45, surpassing both ocular disease and trauma combined. Among this young population, amblyopia has been found to be the leading cause of severe unilateral vision impairment, occurring 10 times more frequently than any other diseases or trauma. According to Vereecken and Brabant, they found that out of 203 cases, only 28.5% experienced an improvement in visual acuity in the amblyopic eye after losing vision in the sound eye. This improvement occurred either spontaneously in 17.4% of cases or after receiving pleotropic treatment in 11.1% of cases. This study aimed to evaluate the prevalence of amblyopia and its related risk factors in school-aged children from the Visnagar region of Gujarat. Additionally, the study aimed to provide appropriate treatment for amblyopia based on its type and monitor the

patients for any improvements. It is crucial to address the risk factors, particularly those that can be changed. One effective way to do this is by educating parents and teachers about the significance of early eye screening in school, which can help prevent amblyopia.

Material and Methods

This study was conducted at the Department of Ophthalmology, a Tertiary Care Teaching Institute in India. It focused on observing 1000 school-going children over a period of 1 year. Only school-going children between the ages of 5 and 16 within a 3km radius of the Visnagar region in Gujarat were considered for this study. Children with any abnormalities in the front or back of the eye, except for congenital cataract and ptosis, as well as those with a history of eye trauma or surgery, were not included.

The school principal was contacted to obtain permission for screening children on a specific date. Higher secondary schools, both government and private, were chosen from urban and rural areas in the Visnagar region of Gujarat. All the children who met the criteria for inclusion were screened and examined during a visit to their school.

A questionnaire was used to gather a comprehensive sociodemographic history, including information about age, gender, and socioeconomic status. Children between the ages of 5 and 16 had their visual acuity assessed using a Snellens visual acuity chart. Following that, their anterior segment was examined using a torch light, and fundus examination was conducted using direct and indirect ophthalmoscopy.

A total of 25 cases of amblyopia were detected and thoroughly studied. The patient's complaints were documented in the order they occurred, and a thorough history of their current illness was obtained. Please provide information about any previous incidents of eye trauma, surgery, or infection. Family members were questioned about any previous instances of similar illnesses. Next, an ocular examination was conducted to check for amblyopia.

Visual acuity: The Snellen's distant visual acuity chart was used to record the distant visual acuity. The visual acuity of each eye, both uncorrected and best corrected, was recorded.

Head posture: Observations were made of any changes in posture or head position.

Ocular movements: Examined the ocular movements by testing both eyes in all nine cardinal directions of gaze.

Anterior segment: During a school visit, a comprehensive external examination of the anterior

segment of each eye was conducted using a torch light and slit lamp. Participants with any visible abnormalities in the front part of the eye were not included in the study.

Fundus examination: A thorough examination of the fundus in both eyes was conducted using both an indirect ophthalmoscope and a direct ophthalmoscope, with the eyes fully dilated.

Hirschberg test: This test was used to evaluate the approximate angle of deviation in cases of strabismic amblyopia.

Performing an alternate and cover/uncover test can help identify heterotropia and heterophoria. The tests were conducted for both near and distance fixation.

Prism Bar Cover Test: The angle of deviation for retinoscopy, cyclopentolate 1% eye drops were administered in each eye and repeated every 15 minutes for 60 minutes to achieve full mydriasis. After retinoscopy, the refraction procedure was performed. Initially, dry retinoscopy was performed and the results were promptly accepted. Subsequently, wet retinoscopy was conducted following the administration of 1% cyclopentolate eye drops. Glasses were then prescribed after a post mydriatic test conducted three days later. Children with refractive error were provided with refractive correction during a school visit, after being called in for an eye examination. Additionally, children with amblyopia received refractive correction as part of their management plan. Patients with amblyopia received treatment through optical correction with glasses, occlusion, and surgical interventions for strabismus and ptosis.

The patching was conducted using a micropore eye patch, following a specific schedule.

For mild amblyopia, it is recommended to patch the normal eye every two hours while engaging in consistent near work.

For moderate to severe amblyopia, it is recommended to patch the normal eye every 4 to 6 hours while engaging in constant near work.

A method of patching the eye was used at different intervals to treat ametropic amblyopia. The categorisation of amblyopia types was based on the guidelines provided by the American Academy of Ophthalmology, as well as the severity of the condition. Every child was monitored at 1 month, 3 months, and 6 months. Snellen's distant visual acuity chart was used.

Statistical Analysis: The data was compiled and entered into a spreadsheet computer program (Microsoft Excel 2019) and then exported to the data editor page of SPSS version 19 (SPSS Inc., Chicago, Illinois, USA). Quantitative variables were reported using measures such as means and

standard deviations or median and interquartile range, depending on their distribution. The qualitative variables were displayed as counts and percentages. Confidence level and level of significance were set at 95% and 5% respectively for all tests.

Results

1000 children, aged 5 to 16 years, underwent screening. According to the study, 25 children were found to have amblyopia, which accounted for 2.5% of the participants. Men make up 56% of the cases. Approximately 40% of the cases came from

a lower socio-economic background. Anisometropia emerged as the primary risk factor linked to amblyopia, accounting for 53.33% of cases. A majority of patients experienced unilateral amblyopia, with a significant number falling into the moderate category. Out of the 25 amblyopic cases, a significant improvement in visual acuity of more than 2 Snellen lines was observed in 16 cases. The relationship between the length of occlusion therapy and visual improvement in children with amblyopia did not reach statistical significance ($p>0.05$).

Table 1: Distribution according to demographic variables of children screened

Variables	Number of children (n=1000)	Percentage (%)
Age group (years)		
5-8	320	32
9-12	350	35
13-16	330	33
Gender		
Male	520	52
Female	480	48

Table 2: Distribution of children with amblyopia according to demographic variables

Variables	Number of cases (n=25)	Percentage (%)
Age group (years)		
5-8	6	24
9-11	7	28
12-14	7	28
15-16	5	20
Gender		
Male	14	56
Female	11	44

Table 3: Distribution according to Risk factors and Characteristics of amblyopia

Characteristics of amblyopia	Number of cases (n=25)	Percentage (%)
Risk factors		
Anisometropia	13	52
Myopia	2	8
Hypermetropia	2	8
Astigmatism	1	4
Strabismus	5	20
Ptosis	1	4
Congenital cataract (blue dot)	1	4
Type of amblyopia		
Anisometropic	13	52
Ametropic	4	16
Meridional	1	2
Strabismic	5	20
Sensory deprivation	2	8
Laterality		
Bilateral	4	16
Unilateral	21	84
Grading		
Mild	10	40
Moderate	12	48
Severe	3	12

Discussion

Amblyopia and related strabismus can have significant negative impacts on a person's mental well-being and financial situation. Not being able to develop binocular vision and having visual impairment in one or both eyes can limit a person's career options. Severe amblyopia is also seen as a major risk for blindness if someone loses vision in their other eye. Early detection and prompt treatment have proven effective in reducing the occurrence of amblyopia, as demonstrated by numerous countries that have implemented widespread education and visual screening programs to enhance public understanding and awareness of this condition.

In India, there have been regional studies that focus on childhood blindness and the prevalence of refractive errors. These studies have found that amblyopia is a common cause of visual impairment. According to a recent study conducted in India, there is a significant concern regarding childhood blindness, specifically related to amblyopia after cataract surgery. This study emphasises that amblyopia is a leading cause of preventable low vision in children. In another study conducted by the same authors on planning low vision services in India, amblyopia was identified as one of the primary causes of paediatric low vision, affecting approximately 26% of the children examined. There haven't been any studies that specifically focused on amblyopia and examined the patient profile, age of presentation, and other demographic details. [8]

In the present study, the prevalence of amblyopia was found to be 2.5%. This result aligns closely with a study conducted by Saxena et al [9], where the prevalence was reported to be 2.11%. However, in a study by Anjaneyulu et al [10], the prevalence was higher at 6.6% compared to the present study. There may be a difference in the findings between the study conducted by Anjaneyulu et al and the present study due to the fact that the former only included government school children, while the latter included both government and private school children. There may be variations in the prevalence of amblyopia among different studies, which could be attributed to factors such as regional differences, sample sizes, and the various methods and criteria used for diagnosing amblyopia.

According to a study by Anjaneyulu et al, it was found that half of the cases of amblyopia occurred in children aged 6-9 years, while the other half occurred in children aged 10-15 years. In a study conducted by Jarwal et al [11], they found that the highest prevalence of amblyopia was observed in the 5-10 years age group. According to the study, a significant number of cases of amblyopia were observed in children aged 5-10 years. This could be

attributed to a lack of compliance with wearing spectacles after refractive correction. Interestingly, there was not a significant difference observed between the two age groups. Our study found that amblyopia was observed in 44% of females and 56% of males. In previous studies by Gupta et al [12] and Jarwal et al [11], a slight male predominance was observed for amblyopia, which aligns with the findings of this study. One possible reason for this gender discrepancy could be the fact that fewer girls tend to seek medical attention or attend school, particularly in rural areas. Additionally, there may be a higher male-to-female ratio in the overall population.

In our study, we found that amblyopia was more prevalent among children from lower socioeconomic backgrounds, with a rate of 40%. The findings of Ikuomenisan et al. also supported these results. [13] It is possible that the lack of education and awareness about regular eye check-ups, the importance of wearing glasses, limited access to healthcare, and a lack of knowledge about minor eye issues could contribute to this problem. Additionally, there may be a lack of advertising through electronic and print media to inform the public about amblyopia. It is crucial for the government to raise awareness among the general population about amblyopia, just like they do for cataract, glaucoma, and other preventable causes of blindness. Taking timely preventive measures can help prevent amblyopia and avoid permanent visual impairment, which is contributing to the growing burden of social blindness.

The most common risk factors found in this study for amblyopia were anisometropia, followed by strabismus, hypermetropia, myopia, astigmatism, ptosis, and congenital cataract. However, no cases of prematurity or low birth weight were observed. In a recent study conducted by Mohammad et al, a noteworthy correlation was found between amblyopia and both low birth weight (LBW) and preterm birth. The severity and prevalence of amblyopia rise as the level of anisometropia increases. [14,15] Patients who are hypermetropic with anisometropia of a one Diopter difference may experience amblyopia, whereas myopic individuals with anisometropia typically do not develop amblyopia unless the anisometropia is significant.

Identifying amblyopia at an early stage and providing the right treatment can greatly reduce the risk of long-term visual problems.

According to the study, there was a higher percentage of unilateral amblyopia cases (84%) compared to bilateral amblyopia cases (16%). This could be attributed to the brain's natural tendency to suppress the less efficient eye and promote the better eye, resulting in improved visual quality. As a result, there were more cases of unilateral

amblyopia. In a study conducted by Jarwal et al [12], it was found that a higher percentage of participants had a moderate degree of amblyopia (64%) compared to those with a severe degree (36%). It is worth noting that the present study included a higher number of anisometric amblyopes compared to strabismic amblyopes. It is well-established that strabismic amblyopia is often associated with a more severe degree of amblyopia. It's crucial to keep in mind that amblyopia is frequently diagnosed after ruling out other conditions. It is important to consider other potential causes of low vision before concluding that a patient has amblyopia.

Conclusion

Present study showed the prevalence of amblyopia in school going children to be 2.5% which in itself shows as one of the major hidden visual problems in the society which can be prevented by early identification and proper management in appropriate time. Most common causative risk factor of amblyopia in relation to refractive error was found to be with anisometropia.

Early diagnosis and treatment can prevent and minimize risk of permanent deficit of vision in amblyopia if detected earlier especially before 10 years of age. Screening programs in school going children can detect amblyogenic factors earlier to prevent major permanent deficit in vision by amblyopia so screening of children should be done through school surveys, awareness should be spread through various campaigns among the teachers and parents of the children about amblyopia and its adverse consequences not only on visual impairment part but also functional, psychological, social, economic impact.

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