



## Original Research Article

## A prospective study of amblyopia and its risk factors in selected school going children of Bhopal region

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## ABSTRACT

**Background:** In vision 2020, amblyopia is a major preventable and treatable cause of low vision in paediatric age group. If not treated at appropriate time, paediatric amblyopia can result into monocular and binocular low vision with associated deterioration in Quality of Life indices in adulthood. This should be the hallmark of the blindness control programme in India. So this study was carried out to assess the magnitude of amblyopia and its associated risk factors in school going children and to correct the amblyopia by whatever treatment modality possible depending upon the type of amblyopia and to follow up the patient for any improvement in it.

**Materials and Methods:** This was a prospective, observational study on 1200 school going children between 5-16 years of age. All the children were subjected to visual acuity examination. Those children with refractive error were further screened at Hospital.

**Results:** Out of 1200 cases, 30 cases had amblyopia. Prevalence of amblyopia was 2.5%. Anisometropia was the most predominant risk factor associated with amblyopia (53.33%). Anisometric amblyopia (53.33%) was most common. Amblyopia was more common in children with lower socio-economic background (40%). Maximum patients had unilateral (80%) and moderate amblyopia (46.7%). Association between duration of occlusion therapy and visual improvement in children with amblyopia was statistically insignificant ( $p=0.19$ ).

**Conclusion:** Amblyopia is one of the major hidden visual problem in the society which can be prevented by early identification and proper management in appropriate time. 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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### 1. Introduction

Amblyopia is a decrease of visual acuity in one eye when caused by abnormal binocular interaction or occurring in

one or both eyes as a result of pattern vision deprivation during visual immaturity, for which no cause can be detected during the physical examination of the eye(s) and which in appropriate cases is reversible by therapeutic measures if taken timely.<sup>1</sup> Prevalence of amblyopia in Asian children is reported as 1.81%.<sup>2</sup> In Indian study in

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Kurnool district of Andhra Pradesh, amblyopia prevalence was documented to be 6.6%.<sup>3</sup>

Risk factors associated with amblyopia are 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, lower socioeconomic background.<sup>4</sup>

Amblyopia has functional, psychological, social and economic impact, thus it can influence learning, performance in school, social activities and, can also restrict the child's choice of a career and hobbies. If amblyopia is left untreated then permanent visual loss or deficit can occur. The US Preventive Services Task Force (USPSTF) recommends vision screening for all children of age 3 to 5 years. With the help of volunteer-based organizations, school programs and ophthalmologists successful vision screening programmes can be done.<sup>5</sup>

In Vision 2020, amblyopia is a major preventable and treatable cause of low vision in paediatric age group. If not treated at appropriate time, paediatric amblyopia can result into monocular and binocular low vision with associated deterioration in Quality of Life indices in adulthood. Therefore it should be a priority to take measures for early detection and dedicated rehabilitation of amblyopia. This should be the hallmark of the blindness control programme in India. So present study was carried out to assess the magnitude of amblyopia and its associated risk factors in school going children of Bhopal region and to correct the amblyopia by whatever treatment modality possible depending upon the type of amblyopia and to follow up the patient for any improvement in it. Also to rectify the risk factors specially those which are modifiable like spreading awareness among parents and teachers about the importance of eye screening in early school life so that amblyopia can be prevented.

Followings are primary objectives of this study

1. To study the prevalence of amblyopia in school going children.
2. To determine the associated causative risk factors leading to amblyopia in school going children.
3. Secondary.
4. To study the sociodemographic profile of amblyopia in school going children.
5. To find out the role of occlusion therapy in relation to age and duration of amblyopia.

## 2. Materials and Methods

The present study was conducted as a prospective, observational study at Department Of Ophthalmology, Gandhi Medical College, Bhopal on 1200 school going

children during the period from November 2018 to August 2020 (22 months). All the school going children between 5-16 years of age in a radius of 3km around Hamidia Hospital Bhopal were included whereas children with anterior segment or posterior segment abnormality; any congenital ocular anomaly other than congenital cataract and ptosis and with history of ocular trauma or any ocular surgery were excluded.

After obtaining ethical clearance from Institute's ethical committee, written consent was taken from all the parents of children. Permission for screening of children on particular date was taken from the respective school principal. Government and Private Higher secondary Schools were selected from both urban and rural areas around the Hamidia Hospital Bhopal. All the children fulfilling the inclusion criteria were screened and examined during school visit.

Detailed sociodemographic history pertaining to age, gender, socioeconomic status was obtained using questionnaire. Visual acuity of all the children of age group 5-16 years was checked on distant Snellens visual acuity chart then torch light examination of anterior segment and direct and indirect ophthalmoscopy for fundus examination was done. Those children who had reduced visual acuity and abnormal ocular findings were referred to eye OPD in hamidia hospital Bhopal.

A total 30 cases of amblyopia detected and all of them were studied in detail. The presenting complaints were recorded in chronological order and detailed history of presenting illness was taken. Past history of any ocular trauma or ocular surgery or infection taken. Any history of similar illness in family members was asked.

Then ocular examination for amblyopia was done under following headings:

### 2.1. Visual acuity

Distant visual acuity was noted on Snellen's distant visual acuity chart. Uncorrected and best corrected visual acuity of each eye was recorded.

### 2.2. Head posture

Any turn tilt or chin elevation was noted.

### 2.3. Ocular movements

Ocular movements of both eyes were tested in all nine cardinal direction of gaze.

### 2.4. Anterior segment

A thorough external examination of anterior segment of each eye was made with torch light during school visit and with slit lamp of those children who attended eye opd of Hamidia hospital Bhopal. Those who had any gross pathology in anterior segment were excluded from the study.

### 2.5. Fundus examination

A detailed fundus examination of both eyes was carried out under full mydriasis by indirect ophthalmoscope and direct ophthalmoscope

### 2.6. Hirschberg test

This test was applied in strabismic amblyopia cases to assess approximate angle of deviation

Position of corneal reflex	Angle of deviation
1. On the margin of pupil	15 degree
2. Half way between pupillary margin and limbus	25 degree
3. On the limbus	45 degree

Alternate and cover/uncover test- to detect heterotropia and heterophoria. These tests were performed both for near and distance fixation.

Prism Bar Cover Test- angle of deviation

Retinoscopy- For retinoscopy cyclopentolate 1% eye drop was instilled in each eye and repeated in every 15 min for 60 minutes till full mydriasis.

Refraction was done after retinoscopy. First dry retinoscopy was done and immediate acceptance was noted then wet retinoscopy was done after instilling 1% cyclopentolate eye drop and glasses were prescribed after 3 days(post mydriatic test). Refractive correction was given to those children who had refractive error during school visit after being called in eye OPD and also to children with amblyopia as one of the management procedure. The amblyopic patients were treated by optical correction with glasses, occlusion and by operative intervention like surgery for strabismus and ptosis.

Patching was done using micropore eye patch according to following schedule-

1. Mild amblyopia – 2 hourly patching of normal eye with constant near work.
2. Moderate/severe amblyopia – 4 hourly or 6 hourly patching of normal eye with constant near work.

\*Alternate 2/4/6 hourly patching of eye was done in case of ametropic amblyopia.

Amblyopia types were categorised on the basis of American Academy of Ophthalmology<sup>6</sup> and severity of amblyopia.<sup>7</sup>

All the children were followed up after 1 month, 3 months and 6 months. Visual improvement was tested on each follow up visit by Snellen's distant visual acuity chart.

### 2.7. Statistical analysis

Data was compiled using MS Excel and analysed using IBM SPSS software version 20. Data was grouped and

expressed as proportions. Chi square test was used to assess the association between proportions and p value of less than 0.05 was considered statistically significant.

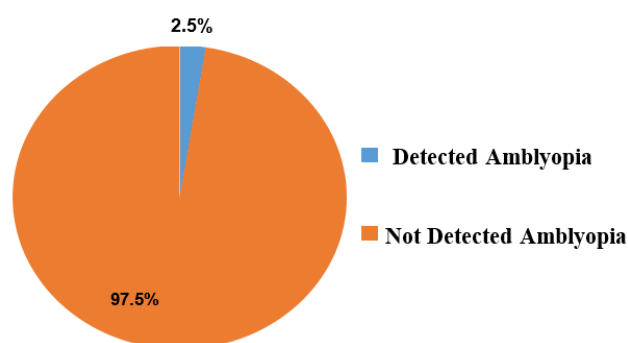
### 3. Results

A total of 1200 children were screened between the age range of 5 and 16 years.

**Table 1:** Distribution according to sociodemographic variables of children screened

Sociodemographic variables		Number of children (n=1200)	Percentage (%)
Age group (years)	5-8 years	373	31.08
	9-12 years	428	35.66
	13-16 years	399	33.25
Gender	Male	620	51.66
	Female	580	48.33

Majority i.e. 35.66% children belonged to 9-12 years of age and about 51.66% were males.



**Fig. 1:** Prevalence of amblyopia in school going children

In present study, 30 children had amblyopia (2.5%).

Males comprises of 56.66% cases. About 40% cases belonged to lower socio- economic background.

Anisometropia was the most predominant risk factor associated with amblyopia (53.33%). Anisometric amblyopia was most common (53.33%). Maximum patients had unilateral (80%) and moderate amblyopia(46.7%).

Among 30 amblyopic cases 19 cases (66.66%) showed improvement in >2 snellens line in visual acuity. The observed association between duration of occlusion therapy and visual improvement in children with amblyopia was statistically insignificant (p>0.05).

### 4. Discussion

Amblyopia has become a growing socio-economic problem as it is one of the most neglected common sensory anomalies of the eye. Prevalence of amblyopia in present study was

**Table 2:** Distribution of children with amblyopia according to sociodemographic variables

		Number of cases (n=30)	Percentage (%)
Age group (years)	5-7	8	26.66
	8-10	9	30
	11-13	8	26.66
	14-16	5	16.66
Gender	Male	17	56.66
	Female	13	43.33
Socioeconomic status	Upper class	2	6.66
	Upper middle	2	6.66
	Lower middle	6	20
	Upper lower	8	26.66
	Lower	12	40

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

Characteristics of amblyopia		Number of cases (n=30)	Percentage (%)
Risk factors	Anisometropia	16	53.33
	Myopia	2	6.66
	Hypermetropia	3	10
	Astigmatism	1	3.33
	Strabismus	6	20
	Ptosis	1	3.33
	Congenital cataract (blue dot)	1	3.33
Type of amblyopia	Anisometropic	16	53.33
	Ametropic	5	16.66
	Meridional	1	3.33
	Strabismic	6	20
Laterality	Sensory deprivation	2	6.66
	Bilateral	6	20
	Unilateral	24	80
Grading	Mild	12	40
	Moderate	14	46.66
	Severe	4	13.33
Refractive error	Myopia	8	26.66
	Hypermetropia	15	50
	Astigmatism	7	23.33
Squint	Esotropia	2	6.66
	Exotropia	4	13.33

**Table 4:** Distribution of amblyopic cases in accordance with effect of duration of occlusion therapy on visual improvement

Duration of patching	Amblyopia grading	Number of cases with >2 snellens line improvement	Percentage (%)
2 hours	12 (mild)	9	75
4 hours	14 (moderate)	9	64.28
6 hours	4 (severe)	1	25
$\chi^2$		3.2	
P value		0.19	

2.5% which was quite similar to study done by Saxena et al<sup>8</sup>(2.11%) however in Anjaneyulu et al<sup>3</sup> (6.6%) it was higher than present study. The observed difference in present and study by Anjaneyulu et al could be because that included only government school children while present study included both government and private school children. Difference in prevalence of amblyopia among various study may be due to regional factors, sample size, various methods and criteria used for diagnosing amblyopia.

In the literature, no definite relationship of amblyopia to any particular age group has been described. Anjaneyulu et al<sup>4</sup> observed 50% of amblyopia were between 6-9 years age group and 50% were between 10-15 years age group. Jarwal et al<sup>9</sup> documented maximum prevalence of amblyopia (51.61%) in 5-10 years age group. In the present study, maximum cases (56.66%) of amblyopia were found in the age group between 5-10 years which could be due to decreased compliance for spectacles in 5-10 years age group children after refractive correction, however there was not much difference found in between both the age groups. In our study, amblyopia was noted in 43.3% females and 56.66% males. This was similar to the study of Gupta et al<sup>10</sup> and Jarwal et al<sup>9</sup> in which slight male predominance was observed for amblyopia. An explanation for this gender discrepancy may be due to the bias that fewer girls report to hospitals and schools especially in rural areas and higher male female ratio in general population.

Amblyopia was more common in children with lower socioeconomic background (40%) in our study. These findings were supported by findings of Ikuomenisan et al.<sup>11</sup> This could be probably due to illiteracy and lack of awareness of regular eye check-ups, the importance of using spectacles, less affordability for hospital reach, ignorance of minor complaints, less or no advertisement to aware the population through electronic and print media about the amblyopia. Government needs to promote the awareness in general population similarly like cataract, glaucoma and other preventive blindness condition as because amblyopia is also preventable condition if appropriate preventive measures taken timely otherwise it leads to permanent deficit in visual improvement which is increasing the burden of social blindness.

Most common risk factor associated with amblyopia in present study was anisometropia (53.33%) followed by strabismus (20%), hypermetropia (10%), myopia(6.66%), astigmatism (3.33%), ptosis (3.33%) and congenital cataract (3.33%), but no single case of prematurity and low birth weight was observed. Mohammad et al<sup>12</sup> showed a significant association between amblyopia and low birth weight (LBW) as well as preterm birth. However according to The Strabismus, Amblyopia and Refractive Error in Singaporean Children (STARS) study,<sup>13</sup> amblyopia was not associated with LBW, preterm birth, maternal age, or maternal smoking during pregnancy.

Prevalence of anisometropic amblyopia was maximum in our study (53.33%) than other types of amblyopia. Similar findings were documented by Janti et al<sup>14</sup> and Jarwal et al<sup>9</sup> in which prevalence of anisometropic amblyopia was higher (36.20% and 29.5% respectively). Reason behind Higher prevalence of anisometropic amblyopia than other type of amblyopia could be due to anisometropia being most common risk factors and usually children do not pay attention for unilateral refractive error for long time.

In present study higher percentage of unilateral amblyopia 24 cases (80%) than bilateral amblyopia 6 cases (20%) which could be due to normal physiological phenomenon of brain, which suppresses the eye which is less efficiently working and promote the better eye in a way to improve visual quality resulted in higher number of unilateral amblyopic cases. The present study found that that majority of cases had moderate amblyopia followed by mild and severe amblyopia. Jarwal et al<sup>9</sup> also observed higher percentage of moderate degree of amblyopia 64% as compared to 36% of severe degree of amblyopia. This might be because present study had more of anisometropic amblyopes than Strabismic, and Strabismic amblyopia is associated with severe degree of amblyopia.

The present study observed no association between duration of occlusion therapy in between 2 hours, 4 hours and 6 hours eye patching during active time period and visual improvement. Holmes et al<sup>15</sup> concluded that 6 hours of prescribed daily patching produces an improvement in visual acuity that is similar in magnitude to full time occlusion therapy prescribed to treat severe amblyopia (20/100 to 20/400) in children less than 7 years of age. Duration of patching during most active time period of child plays a crucial role to encourage the suppressed eye to improve physiological functioning of eye and to strengthen the retinocortical fibres. Present study got a shorter time of follow up due to covid pandemic situation that influenced the sample size and follow up period of children resulted in slightly different outcome of occlusion therapy in terms of duration of hours of patching taken and visual improvement. Results could have been different in case of larger sample size.

## 5. Conclusion

Amblyopia is a developmental cortical disorder of the visual pathway that contributes to amblyopia formation essentially due to abnormal visual stimulus reaching the binocular cortical cells which may be multivariate. 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 problem 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.

## 6. Strength of Study

This study was conducted in a tertiary care centre with advanced facilities and skilled faculties for the diagnosis and management of amblyopia.

Being a postgraduate student, this study has made me aware of the importance of timely screening of amblyopia, proper counselling of parents, teachers regarding importance of eye check-up of school going children and the adverse consequences of amblyopia if not treated at appropriate time.

## 7. Weakness

Covid -19 pandemic heavily affected the sample size taken for the study and follow up of the affected amblyopic children resulting in variable results of the present study.

Longer follow up time period is required in amblyopic children which could not been done because of COVID-19 pandemic crisis.

## 8. Opportunity

This study has given me an opportunity to learn the multiple causative risk factors, different types of amblyopia and effect of occlusion therapy in relation to duration of patching and improvement in visual acuity according to children's age.

I also learned various techniques of screening and recent advances in management of amblyopia.

## 9. Source of Funding

None.

## 10. Conflict of Interest

None.

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