



## A STUDY OF MAGNITUDE OF ANISOMETROPIA AND ITS ASSOCIATION WITH AMBLYOPIA IN SCHOOL GOING CHILDREN

### Ophthalmology

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### ABSTRACT

**BACKGROUND:** Visual impairment is a common handicap among school going children. In some, there are significant interocular differences in refractive error (ANISOMETROPIA), which can be accompanied by an interocular difference in visual acuity that is optically uncorrectable (AMBLYOPIA). The co-occurrence of these two anomalies with no additional abnormality is ANISOMETROPIC AMBLYOPIA. Present study is aimed to study magnitude of ANISOMETROPIC AMBLYOPIA in children.

**OBJECTIVES:** To study the magnitude of Anisometropia and its association with amblyopia in school going children. To identify amblyopic children and provide suitable treatment.

**MATERIALS AND METHOD:** A cross-sectional study done over a period of 18 months at a tertiary health care center. School going children of age 7-17 years with refractive error were assessed of their refractive status, ocular examination including slit lamp examination and fundoscopy was done. Children with interocular refractive error difference of  $>0.75$  D were labelled as Anisometropic. Children whose best corrected visual acuity difference of both the eyes was more than two lines on Snellen's chart in absence of other organic cause were considered Amblyopic. Prevalence of anisometropia and its relation with amblyopia was determined. Data were analyzed by Chi-square test. Appropriate refractive correction was given.

**RESULT:** Out of 100 ametropic children, 14 were anisometropic. Out of 14 anisometropic children 5 were amblyopic. Association between anisometropia and amblyopia was statistically significant ( $p$  value  $< 0.05$ ). It was found that as severity of anisometropia increases, predisposition of development of amblyopia also increases.

**CONCLUSION:** Refractive anisometropia has a considerable prevalence and is a well-known amblyogenic factor in children. Timely intervention should be done to prevent permanent vision loss.

### KEYWORDS

Anisometropia, Amblyopia, Ametropia

### INTRODUCTION

Anisometropia is a condition wherein the refraction of two eyes are unequal. It needs to be detected early and addressed timely to avoid the development of amblyopia and squint. The magnitude of anisometropia is around 20% for an inter-ocular difference of 0.5D or greater in spherical equivalent refraction, falling to 2-3% for an inter-ocular difference of 3D or above. Anisometropia prevalence is relatively high in the weeks following birth, in the teenage years coinciding with the onset of myopia and in older adults starting after the onset of presbyopia. It is about one-third the prevalence of bilateral refractive errors of same magnitude. Amblyopia is present in 1-3% people, one half to two thirds of amblyopes have anisometropia either alone or in combination with strabismus. The frequent co-existence of amblyopia and anisometropia at a child's first clinical examination promotes the belief that the anisometropia has caused the amblyopia, as has been demonstrated in animal models of the condition.<sup>[1]</sup> Although anisometropia and amblyopia are often discovered at the same time, for example during a school vision screening, it is widely held that anisometropia is a precursor to, and indeed cause of amblyopia. Definitive evidence that anisometropia universally precedes development of amblyopia is lacking and simplicity of this cause and effect relationship continues to be challenged.<sup>[2][3]</sup>

Anisometropic amblyopia is also of major significance from clinical perspective. Given that anisometropia is present in half to two-thirds of amblyopes, it is evident that anisometropic amblyopia represents an important public health concern.<sup>[4][5][6][7]</sup> Amblyopia (lazy eye) is the most common cause of monocular vision loss in children and as it is a major preventable and treatable cause of pediatric low vision, early detection and treatment of amblyopia is a very important. It poses an important socioeconomic problem, especially since the risk of amblyopic patient becoming blind is significantly higher than in the general population<sup>[8]</sup>. Screening programs in school children would detect not only amblyopia, but also the other amblyogenic factors like ametropias, strabismus and visual deprivation, the diagnosis and treatment of which in time will prevent amblyopia and subsequent vision loss. Present study is conducted to determine the magnitude of anisometropia and its association with amblyopia in school going children.

### MATERIALS AND METHODOLOGY

A hospital based cross sectional study was conducted in tertiary care center after approval of institutional ethic committee.

Total 100 patients were included, who were school going children of age 7-17 years coming to tertiary care center. Prior consent of their parents was taken. Demographic data of all the children and their detailed history was noted. Refractive error was checked. A thorough ocular examination including slit lamp and fundus examination was performed.

**Study design** - Cross sectional for a total duration of 18 months (January 19- July 20).

**Sample size** - All the children of age 7-17 years with refractive error between given time duration, not having any exclusion criteria and whose parents gave consent for the study were included.

### INCLUSION CRITERIA-

- 1 All children of age 7-17 years with refractive error.
- 2 All those Children whose parents gave consent for the study were included in the study.

### Exclusion criteria (All/any of the following) –

- 1 Children suffering from any ocular pathology other than refractive error.
- 2 Children having history of ocular trauma.
- 3 Those children whose parents did not give consent for the study.

### STATISTICAL METHOD-

demographic data like age and gender has been evaluated and shown in percentage. SPSS 20 and OPENI software were used to calculate statistical significance. Chi square test was used. P value  $< 0.05$  was considered statistically significant.

**Assessment of refractive status** visual acuity of all children were notes (unaided and with pinhole).

- Auto refraction and subjective testing was done
- Cycloplegics were instilled and dilated auto refraction done

- Retinoscopy was carried out in a dark room using streak retinoscope
- Post- mydriatic testing and best corrected visual acuity noted
- Children having unequal refractive error between eyes were called Anisometropic.
- Among anisometropia, those having amblyopia identified according to guidelines of American academy of ophthalmology<sup>[9]</sup>

**Anisometropia criteria-** difference in sphero-cylindrical refractive error between both eyes, with clinically significant difference >0.75 D

**Amblyopia criteria-** best corrected interocular visual acuity difference of both eyes, two lines and more on snellen's chart in absence of any other organic cause

**Slit lamp examination** – it was carried out to microscopically examine all the ocular structure including eyelids, conjunctiva, iris, lens, sclera, cornea and anterior chamber. Fundus examination by direct and indirect ophthalmoscopy, <78 dioptre lens by slit lamp biomicroscopy was done. Intraocular pressure by non-contact tonometer was measured. All the pathologies of retina – retinopathies, retinal vein/ artery occlusion, vasculitis, retinal detachment degeneration were ruled out.

**Treatment** – after refractive assessment, children with refractive error were prescribed glasses. Those diagnosed with amblyopia were treated as Amblyopia treatment studies (ATS) done by Pediatric eye disease investigator group (PEDIG)<sup>[10]</sup> research. Regular follow up advised.

**OBSERVATION AND RESULTS**

- There were total 100 students with refractive error from which females were 51 (51%) and males were 49 (49%)
- 100 children of age 7-17 were distributed into 5 groups according to their age. Maximum 27 children with refractive error fall into age group of 13-14 years, followed by 23 and 22 in age group of 9-10 years and 11-12 years respectively. 18 were found in age group 15-17 years and lowest 10 in age group 7-8 years.
- Refractive error of individual eye was determined. In right eye astigmatism was found in 66 eyes, followed by myopia found in 30 eyes and hypermetropia in 3 eyes, emetropia in 1 eye.
- Similar results found in left eye. Astigmatism was found in 61 eyes, myopia in 32 eyes and hypermetropia in 4 eyes. Emmetropia was found in 3 eyes.
- Prevalence of anisometropia

**Table 1**

	No of cases	Percentage
ANISOMETROPIC	14	14%
ISOMETROPIC	86	86%
GRAND TOTAL	100	

In table 1, out of 100 children, 14 had interocular difference of >0.75 D in their spherical equivalent making them anisometropic. Refractive status of 86 other children was isometropic.

- Gender wise grouping of 14 anisometropic children was done, showing equal number of cases in both females and males. P value was found 0.4678 (>0.05) making any relation between gender and anisometropia statistically insignificant.
- Age wise stratification of anisometropia was done. It was found that maximum children 6 were in age group 7-10 years followed by 4 in 11-14 years and 4 in 15-17 years. P value was found 0.3344 (>0.05), proving no significant association between age and prevalence of anisometropia.
- Prevalence of different types of anisometropia

**Table 2**

TYPE OF ANISOMETROPIA	TOTAL	PREVALENCE
SIMPLE MYOPIC ANISOMETROPIA	1	7.14%
SIMPLE HYPERMETROPIC ANISOMETROPIA	1	7.14%
COMPOUND MYOPIC ANISOMETROPIA	5	35.71%
COMPOUND HYPERMETROPIC ANISOMETROPIA	2	14.28%
MIXED ANISOMETROPIA	0	0%
SIMPLE ASTIGMATIC ANISOMETROPIA	3	21.42%
COMPOUND ASTIGMATIC ANISOMETROPIA	2	14.28%

In table 2, prevalence of different types of anisometropia was determined. It showed that compound myopic anisometropia showed highest prevalence (35.71%) followed by simple astigmatic anisometropia (21.42%). compound hypermetropic anisometropia and compound astigmatic anisometropia showed equal prevalence of 14.28%. least prevalence (7.14%) was found in simple myopic anisometropia and simple hypermetropic anisometropia.

- Association between anisometropia and amblyopia

**Table 3**

	AMBLYOPIC	NON - AMBLYOPIC	NO OF CASES	P VALUE
ANISOMETROPIC	5	9	14	0.000002803
ISOMETROPIC	2	84	86	

In table 3, prevalence of amblyopia was determined in anisometropic and isometropic children. It was seen in anisometropic cases, significant number 5 out of 14, had amblyopia. In isometropic 2 out of 86 had amblyopia. This shows a considerable prevalence of amblyopia 35.71% in anisometropia. P value evaluated was 0.000002803 (<0.05), hence showing significant association between anisometropia and amblyopia.

- Grading of anisometropia according to severity

**Table 4**

GRADING OF ANISOMETROPIA	NO OF CASES	PERCENTAGE
MILD ANISOMETROPIA	6	42.85%
MODERATE ANISOMETROPIA	4	28.57%
SEVERE ANISOMETROPIA	4	28.57%
ISOMETROPIC	86	
GRAND TOTAL	100	

In table 4, Grading of anisometropia was done in three categories according to severity. Highest cases 6 were having mild anisometropia. Equal of cases 4 each were seen in moderate and severe anisometropia.

Co-relation between severity of anisometropia and amblyopia

**Table 5**

TYPE OF ANISOMETROPIA	NO OF CASES	AMBLYOPIA (NO OF CASES)	PERCENTAGE	P VALUE
MILD ANISOMETROPIA	6	1	16.66%	0.000003204
MODERATE ANISOMETROPIA	4	1	25%	
SEVERE ANISOMETROPIA	4	3	75%	
TOTAL NO OF CASES	14	5		

The above table 5, shows co-relation between severity of anisometropia and amblyopia. 75% of children with severe anisometropia also had amblyopia. 25% of moderate anisometropia had amblyopia and 16.66% of mild anisometropic children had amblyopia. It is evident from the above table that as severity of anisometropia increases, chances of amblyopia also increases. P value found was 0.000003204 (<0.05) which means that correlation is statistically significant.

- Total amblyopia cases seen in both anisometropic and isometropic children were categorized into moderate amblyopia and severe amblyopia. Out of total 7 cases, 5 had moderate amblyopia and 2 had severe amblyopia.

**DISCUSSION**

Anisometropia is a state of unequal refractive error between eyes. Minor amount of anisometropia remains undetected and doesn't cause any significant visual problem, however a difference of >1.0 D in a child can lead to amblyopia and development of squint if not corrected properly and timely. frequent co-existence of both conditions have been found in literature. Studies have shown that early screening for amblyopia results in better outcomes. Countries that have instituted early vision screening programs gave reduced rates of amblyopia. Present study includes 100 school going children of age 7-17 years

with ametropia. They were grouped according to refractive error and prevalence was found for each. It showed considerable prevalence (14%) of anisometropia, which closely corresponds to a population based study on anisometropia in Tehran, Iran where prevalence of anisometropia was 17% [11]. Association between anisometropia and amblyopia was seen. Out of 14 anisometropic children, 5 had amblyopia. Results were evaluated using chi square test and p value found was  $<0.05$  hence proving significant association. Prevalence of amblyopia in anisometropic patient was found to be 35.7%. In a study done by S. BROWN in Victor, Australia, anisometropia was statistically more common in amblyopic cases (p value  $<0.0001$ ), proving a relationship between two [12]. In a study done by SHAHET AL, prevalence of anisotropic amblyopia was found to be 43%.

Timely correction of anisometropia is of utmost importance to prevent development of anisometropia and its complication amblyopia. Screening programs in school children would detect not only amblyopia, but also the other amblyogenic factors like ametropia, strabismus, and visual deprivation, diagnosis, and treatment of which in time will prevent amblyopia and subsequent visual loss.

## CONCLUSION

Present study shows that refractive anisometropia has a considerable prevalence and is well-known amblyogenic factor in children. It is also an evident fact that adults with anisometropia, uncorrected after the age of visual maturation, demonstrate some degree of amblyopia. Early detection of refractive anisometropia in children with timely intervention could prevent permanent impairment in binocular vision and stereopsis. Routine screening programs for surveillance and screening of anisometropia and amblyopia is to be encouraged especially among school going children. Role of community ophthalmology is also of utmost importance in prevention of development of amblyopia. Vision 2020 lays stress on rehabilitation of pediatric low vision, of which amblyopia is a major preventable and treatable cause. Detection and treatment of amblyopia should be taken up on a priority basis and form another principle of the national blindness control programme in India.

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