

# Anisometropia in School Going Children

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## Abstract

**Background:** To determine the frequency of anisometropia of  $\geq 1.0D$  in children aged 05 to 15 years.

**Methods:** In this cross sectional study, children aged between 5 and 15 years presenting with impaired vision were examined to diagnose the cause. Complete ocular examination was performed including retinoscopy for prescription of glasses. Cycloplegic refraction and post mydriatic test was done where indicated. Children, having refractive error as the sole cause of impaired vision, were included in the study and those having anisometropia of  $\geq 1.0D$  were noted for result calculation.

**Results:** The mean age of patients (n=100) was  $9.56 \pm 6.0$  years ranging from 5 to 15 years. There were 40 male and 60 female children. Considering the type of refractive error, 26% were myopes and 74% were hypermetropes. Anisometropia of  $\geq 1.0D$  was seen in 9 out of 100 children with refractive error as the sole cause of impaired vision. There were 2 myopes in these 9 patients of anisometropia (20%) while remaining 7 were hypermetropes (78%).

**Conclusion:** Hypermetropia is commoner than myopia (3:1) in the pediatric age group and females were showing a higher incidence of refractive errors than males (3:2). Anisometropia  $\geq 1.0D$  (spherical/cylindrical) was more common among hypermetropes than myopes (78% vs 22%). Anisometropia exists in a significant number of school going children aged 05 to 15 years and needs to be detected early and addressed timely to avoid the development of amblyopia and squint.

**Key words:** Anisometropia, Myopia, Hypermetropia, Cycloplegic refraction, Amblyopia.

## Introduction

The name anisometropia is from four Greek components: an- "not", iso- "same", metr- "measure", ops "eye". So, anisometropia is a state of unequal refractive errors between the two eyes. Minor amount of anisometropia remains undetected and doesn't cause any significant visual problem. However, a difference of  $\geq 1.0D$  in a child can lead to amblyopia

and development of squint if not corrected properly and timely.<sup>1-4</sup>

The visual stimulus is adversely affected by the presence of significant anisometropia in children as one of the macula is receiving relatively blurred image<sup>4,5</sup>. The sharper image of the better eye is processed by the visual pathways and the cortex while the same from the side of blurred image is suppressed<sup>4,5</sup>. This leads to the development of amblyopia. Higher the amounts of anisometropia and the longer it remains uncorrected, denser is the amblyopia which is difficult to treat.<sup>4,5</sup> Success rate of treatment of amblyopia is negligible after 13 years of age. So, anisometropia needs to be detected and addressed early, to help reduce amblyopia burden in adult population.<sup>4,5</sup>

Another important manifestation of anisometropia is the development of squint which is a further complication of amblyopia. This produces a cosmetic blemish and its correction after the amblyopia treatment age passes, is a challenge due to reversal of the squint.<sup>5</sup>

The exact etiology of all the refractive errors including anisometropia has so far not been identified. No single etiological factor can be blamed for the refractive errors, rather they are considered to be the result of a combination of multiple genetic and environmental factors.<sup>6</sup>

For the treatment of anisometropia in children, the corrective spectacle wear is usually sufficient provided the refractive error is less than 3.0D. Contact lenses are prescribed for such higher levels of anisometropia to prevent difference in the image magnification between the two eyes which causes diplopia, if spectacles are used.<sup>6</sup> Early Diagnosis and management of anisometropia is mandatory so as to prevent the development of amblyopia which if persists beyond age 13 may cause a permanent visual acuity deficit.<sup>6</sup>

## Patients and Methods

This was a cross sectional study carried out at Ophthalmology department, Benazir Bhutto Hospital, Rawalpindi from March to August 2013. One hundred children were sequentially sorted out in OPD for refractive errors. Ocular examination was carried out. Visual acuity was checked on Snellen's chart. Anterior

and posterior segment examination was carried out to look for other causes of decreased vision like corneal opacification, cataract, glaucoma, persistent hyperplastic primary vitreous, retinopathy of prematurity, macular scar, congenital optic atrophy, retinal detachment, etc. Orthoptics were done to check for the presence of squint. Children of both genders aged 5-15 years, visiting Benazir Bhutto Hospital, with complaint of reduced vision and found to be having refractive errors as the sole cause of reduced vision, were included in the study. Children with corneal opacity, ptosis, cataract, glaucoma, ocular trauma, uveitis, retinal dystrophies, retinal detachment, and those who refused to give informed consent, were excluded from the study. The participants having anisometropia of at least 1.0D (spherical/cylindrical) were enrolled and their demographic characteristics along with presenting signs and symptoms were recorded. Assessment of distance VA at 6.0M was made with snellen's chart. Cycloplegic refraction was performed after instillation of one drop of proparacaine (0.5%) and three drops of cyclopentolate (1%) 15 minutes apart in each eye. Cycloplegic refraction was performed 40 minutes after instillation of last drop with an auto-refractometer or streak retinoscopy. Post mydriatic test (PMT) was done after three days for prescription of glasses number and detection of anisometropia of  $\geq 1.0D$ .

### Results

The mean age of the study patients was 9.56 years with standard deviation  $\pm 6.0$  years and the age range was 5 to 15 years. About 62% of the study cases were between 5 to 10 years of age (Table 1). Total number of hypermetropes was 74 (74%) while myopes were 26 (26%) with the ratio of 3:1. A total of 9 children were found to be having anisometropia of  $\geq 1.0D$  (9%) among our patient population having refractive errors (Table 2).

**Table 1. Age of study patients. (n = 100)**

Age (years)	No.
5-7	18
8-10	44
11-13	32
14-15	6

**Table 2 .Type of Refractive error in study patients (n=100)**

Sex	No.	Hypermetropes	Myopes	An-isometropia
Male	40	31(77.5%)	9	2
Female	60	43 (71.6%)	17	7

Seven children out of these 9 anisometropes were hypermetropes (78%) while 2 were myopes (22%). (Table 3&4). Among the total of 40 male patients, 77%

**Table 3 .Association of Anisometropia with type of refractive error (n=100)**

Refractive error	Male	Female	Aniso-metropes	Non-anisometropes	% age of anisometropes
Hypermetropia (n=76)	31	43	7	67	9.45%
Myopia (n=26)	9	17	2	24	7.69%

**Table 4: frequency of Ametropes**

Entity	No
Anisometropes	9
Non-anisometropes	91

were hypermetropes while 22.50% were myopes. Among the total 60 female children having refractive errors, 43 (71.66%) were hypermetropes and 17 (28.33%) were myopes. (Table 3) and the distribution of anisometropia among females vs male children was 7:2. (Table 4). Amblyopia was present in (4%) of our patient population having refractive errors as the sole cause of impaired vision and hence (44.4%) of the anisometropes of our study were amblyopic.

### Discussion

Refractive errors are the most common cause of impaired vision during the early years of life.<sup>7, 8</sup> The incidence of the refractive errors reported by different studies varies due to age brackets and ethnic groups of their study populations. Race, geographical area, age brackets, amount of near work, parental education and level of facilities, etc, affect the load of refractive errors in different populations differently.<sup>7-11</sup> Refractive errors are readily diagnosable and can be dealt with effectively in most of the cases. Spectacles bearing corrective lenses are internationally practised devices used for this purpose.

Anisometropia is a condition in which refractive error of two eyes of the person differs. This difference may become intolerable for glasses wear if it exceeds by an amount of algebraic 3 diopters. Anisometropia is also important in the development of amblyopia and squint. As little as 1.0D of anisometropia, if uncorrected, may cause amblyopia.<sup>8,9</sup>

As it is evident from our study that school going children with refractive errors have a significant proportion of anisometropia (9%) which is a known major cause of amblyopia.<sup>12</sup> Amblyopia is a very important pediatric visual problem and needs to be addressed timely. Otherwise visual deficit persists throughout the life as it is not correctable after early

teen ages. Amblyopia is the leading cause of monocular vision loss in young and middle-aged Americans.<sup>12,13</sup> Amblyopia also increases the risk of vision loss in the fellow eye too.<sup>14,15</sup> Treating amblyopia is cost-effective compared with most ophthalmologic and non-ophthalmologic medical treatments.<sup>16</sup>

In present study recorded cases were only those which had a difference of  $\geq 1.0$  D (spherical/cylindrical) between the two eyes and noted that 9% (9/100) of our cases were having anisometropia. In a study by Johnstone WW, 24% of 173 school going children were found to have anisometropia<sup>17</sup>. This high incidence may be due to the differing place of the sample i.e. school vs hospital. In our study, among the 9 anisometropic patients, 4 (44.4%) were found to have amblyopia also, thus bringing an incidence of 4% amblyopia in refractive error harbouring patient population. While comparing our results with previous studies, anisometropia was the cause of amblyopia in 37% of the 409 patients enrolled in a recent, large, prospective, multicenter amblyopia treatment study 1 (ATS 1).<sup>18</sup> In another study by Farooq Q et al anisometropia was present in 136/2504 (5.43%) cases and amblyopia was present in 85 of these children in (62.5%).<sup>19</sup> This difference may arise from the different levels of health care facility available and of course the public awareness about health, etc in different locations of the world. Older studies have demonstrated that anisometropia can be a powerful amblyopiogenic factor due to either the decreased resolution of fovea or the production of active suppression<sup>22-23</sup>

Regarding the frequency of the types of refractive errors, we found 74% of hypermetropia and 26% of myopia in our patient population which is comparable to the results of a study by Caca I where hypermetropes were 65% and myopes were 35%.<sup>24</sup> However this ratio is reported differently in different studies mainly due to differing places of sample. In the study by Farooq Q, et al, myopia was dominating over hypermetropia in a ratio of about 3:1 (1850 vs 654) and anisometropia was more prevalent in hypermetropes than myopes in a ratio of 3:1 (10.7% vs 3.6%).<sup>19</sup> While in our study, although anisometropia was more common among hypermetropia than myopia but the difference was not that high (9.4% vs 7.7%). The difference may arise from a very large sample size of the said study (>74000). In case of gender distribution, study by Caca I showed that there were 53% females and 47% males which is also comparable to our study (60% females and 40% males).<sup>24</sup>

## Conclusion

1. Anisometropia is common among the school going children and it is this age group which is vulnerable to the detrimental effects of anisometropia thus causing visual morbidity and decrease in the functional vision which may be permanent if not diagnosed and managed timely.
2. The child may not detect his visual deficit and many times one is shy enough to disclose his deficiency which may make the amblyopia more dense and of long standing, and thus may reduce the visual output when management is started.
3. Anisometropia and amblyopia should be detected early and addressed timely. Schools must be instructed to schedule annual ophthalmic examination of their students. These measures can help reduce the amblyopia burden in adult population.

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