

## Prevalence of amblyopia in ametropias in a clinical set-up

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### Abstract

**Objective:** To find out prevalence of amblyopia in ametropias in a clinical set-up.

**Materials and methods:** In this retrospective clinical study children from 4-5 years age group to the young adults who attended the eye clinic in one year period were included after taking history, VA test by Snellen's Vision Chart, cycloplegic refraction by streak retinoscope in children and wet or dry retinoscopy in young adults; and a thorough anterior and posterior segment eye examinations by slit lamp biomicroscope and ophthalmoscope to exclude structural abnormality of the eye or the posterior visual pathway defects. A total of 970 eye patients having diminution of vision with ametropias were identified and patients having reduction of visual acuity of greater than two lines between the eyes or an absolute reduction in acuity below 6/9 either eye in Snellen's vision chart which cannot be corrected by refraction were enrolled to find out prevalence of amblyopia.

**Results:** Out of 970 ametropic eye patients amblyopia was present in 56 patients (5.97%) with anisometropias and high bilateral ametropias. The prevalence of amblyopia according to types of ametropias are: hyperopia 6 (10.71%), myopia 2 (3.57%), myopic astigmatism 31 (55.36%), hyperopic astigmatism 11 (19.64%) and mixed astigmatism 6 (10.71%). Sex distribution of amblyopia is male 32 (57.14%) and female 24 (42.86%). Laterality of amblyopia shows: monocular 40 (71.43%) and binocular 16 (28.57%).

**Conclusion:** Out of 970 ametropic eye patients a total of 56 (5.97%) patients have amblyopia. A preschool and school screening program in children in critical period of development of amblyopia must be conducted to find out the ametropias and amblyopia in time; and treat them earlier, by optical correction and amblyopia therapy, effectively and adequately.

**Key words:** Amblyopia, ametropia, anisometropia

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The most widely accepted clinical definition of amblyopia is that condition in which there is deficiency of form or spatial vision sense resulting in the reduction of visual acuity of greater than two lines between the eyes or an absolute reduction in acuity below 6/9 either eye in Snellen's Vision Chart which cannot be corrected by refraction and cannot be attributed directly to the effect of any structural abnormality of the eye or the posterior visual pathway defects. Ametropia causes amblyopia either by anisometropias or high bilateral ametropias.

Amblyopia is present in 2-4% of the general population.<sup>1</sup> A sample survey reveals the incidence in about 1-4% in soldiers and 1.3-3% in preschool and school children<sup>1</sup>. The incidence in Indian school children has been stated to be 0.67%. Of the examined eyes, 60% had the onset of amblyopia between the ages of 1-5 years<sup>1</sup>. Amblyopia is responsible for more unilaterally reduced vision of childhood onset than all other causes combined, with a prevalence of 2-4% in the North American population<sup>2</sup>. The status report of DGHS, Govt. of India shows ametropias as the second largest cause of blindness after cataract<sup>3</sup>.

A clinical study of refractive error profiles in Nepalese population conducted by the author of this article shows myopia-13.68%, hyperopia-42.55%, and astigmatism-43.8%<sup>4</sup>. From the clinical point of view there are four important population-based studies for the cause of monocular vision deficit and blindness<sup>5,6,7,8</sup>. Amblyopia is an important socio-economic problem and one of the top three causes of monocular visual loss in the adult age group<sup>8</sup>. It was the persistence of amblyopia in the adults after amblyopia therapy that two British researchers concluded that visual screening was of little use<sup>9,10</sup>.

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But the recommendation has not been adopted by the British Government. In the USA, the conference held in 1998 has recommended vision screening of preschool children along with the research and field trails of latest photo screening technologies.<sup>11,12</sup>

There are so many research oriented clinical and population based studies in the field of amblyopia in other countries. In Nepal, there are not many studies conducted in this field till date to take as a reference for academic interest or clinical update to knowledge. There is only one random selection of village based clusters study to assess the prevalence of refractive error and vision impairment in school age children in the Terai area of the Mechi Zone in Eastern Nepal. In this study 2.9% of children had visual acuity 0.5% (20/40) or less in one or both eyes without correction. Out of 200 eyes with impairment of vision, amblyopia was present in 9% of eyes.<sup>13</sup>

### Materials and methods

In this retrospective clinical study children from 4-5 years age group to the young adult age group who attended the eye clinic in one year period were included after taking history, visual acuity test by Snellen's Vision Chart, cycloplegic refraction in children and dry or wet retinoscopy in young adults,

a thorough anterior and posterior segment eye examinations by slit lamp biomicroscope and ophthalmoscope to exclude other amblyogenic factors like strabismus and visual stimulation deprivation; and other causes of diminution of vision.

Thus, after a thorough work-up of the eye patients a total of 970 cases having diminution of vision with ametropias only were identified and patients having reduction of visual acuity of greater than two lines between the eyes or an absolute reduction in acuity below 6/9 either eye in Snellen's Vision Chart which cannot be corrected by refraction were enrolled to find out prevalence of amblyopia in ametropias.

### Results

A total of 970 eye patients, had ametropias of different types. Out of those cases, 56 patients (5.97%) had either anisometropias or high bilateral ametropias causing amblyopia. The different types of ametropias causing amblyopia are: hyperopia 6 (10.71%), myopia 2 (3.57%), myopic astigmatism 31 (55.36%), hyperopic astigmatism 11 (19.64%) and mixed astigmatism 6 (10.71%). Sex distribution of amblyopia: male 32 (57.14%) and female 24 (42.86%). Laterality of amblyopia is: monocular 40 (71.43%) and binocular 16 (28.57%).

**Table 1:** Types of ametropias and prevalence of amblyopia

S.No.	Types of ametropias	Amblyopia	
		No.	%
1	Hyperopia	6	10.71
2	Myopia	2	3.57
3	Myopic astigmatism	31	55.36
4	Hyperopic astigmatism	11	19.64
5	Mixed astigmatism	6	10.71
	<b>Total</b>	<b>56</b>	<b>100.00</b>

**Table 2:** Sex distribution of amblyopia

	Amblyopia	
	No.	%
Male	32	57.14
Female	24	42.86
<b>Total</b>	<b>56</b>	<b>100.00</b>

**Table 3:** Laterality of amblyopia

	No.	%
1. Monocular	40	71.43
2. Binocular	16	28.57
<b>Total</b>	<b>56</b>	<b>100.00</b>

## Discussion

Von Graefe described amblyopia as that condition in which the observer sees nothing and the patient very little. Amblyopia is a unilateral or bilateral decrease in visual acuity, caused by deprivation of form vision or abnormal binocular interaction, or both, for which no organic causes can be detected.<sup>14</sup> It results from inadequate or abnormal stimulation of the visual system during a critical early period of visual development.<sup>15</sup> This disorder uniquely occurs during early childhood. Its effects may be permanent if not treated earlier and adequately. Some amblyopes may show retinal abnormalities, but these are not general features of amblyopia.<sup>16</sup> There is cell shrinkage in the parvo cellular layers, which receive input from the amblyogenic eye. This was more marked in the ipsilateral lateral geniculate nucleus<sup>17</sup>. The constant unilateral optical blur due to a difference in refractive error between the two eyes causes cortical suppression of the more ametropic eye and leads to amblyopia. In anisometropia the retinal image in one eye is always de-focused. Moreover, the binocular competition between the blurred image and clear image leads to suppression and consequently amblyopia of the blurred image.

In anisohyperopia amblyopia usually develops in the more hyperopic eye, because the less hyperopic eye is used to focus at all distances, and the more hyperopic eye receives constantly blurred images. The prevalence of amblyopia is reported to reach 100% in anisohyperopia with a difference of 3.5 dioptres<sup>17</sup>. High isometric amblyopia is reduced vision due to bilateral high uncorrected ametropias. A high bilateral hyperopic ametropia greater than 4 dioptres can cause ametropic amblyopia<sup>18</sup>. There is 10.71% anisohyperopic and high hyperopic amblyopia in this clinical study.

In anisomyopia, the less myopic eye is used for targets at distance, and the more myopic eye is used for near target. Therefore, unless the patient has high degree of anisomyopia, each eye has the potential to receive a focussed image. A difference of 3.0 dioptres or more can lead to amblyopia, and the prevalence of amblyopia is 100% when the difference is 6.0 dioptres or more of anisomyopia<sup>19</sup>. High bilateral myopic ametropias of 8 dioptres can develop amblyopia. That is why there is only 3.57% anisomyopic and high bilateral myopic amblyopia.

The astigmatic eye is unable to focus simultaneously lines parallel to its principal meridians. This, if uncorrected, during the critical period results in astigmatic (meridional) amblyopia. Even 2.0 dioptres

of astigmatism can lead to amblyopia in the sensitive period of children. That is the reason why there is a total of 85.7% amblyopia in all types of astigmatism combined together in this study.

Amblyopia is found to be more in male than female. It might be because of the fact that male children are taken care of more than female in our society and brought to the eye centres for the check-up earlier than their female children.

Anisometric ametropias are higher than high bilateral ametropias causing amblyopia. This is the reason for higher percentage of occurrence of monocular amblyopia than binocular.

The prevalence of amblyopia (5.97%) in ametropias is higher as compared to the prevalence of amblyopia (2-4%) in the general population as a whole<sup>1</sup>. This might be explained on the fact that routine pre school and school screening programs to detect and treat ametropias and amblyopias are not carried out in our country. Moreover, there are only a few well-equipped and full-time orthoptic centres to render amblyopia therapy.

## Conclusion

Amblyopia is reported to be a leading cause of monocular visual loss in the 17-70 years old age group surpassing cataracts, macular degeneration, glaucoma and diabetic retinopathy<sup>20</sup>. The WHO has introduced a global initiative for the elimination of avoidable blindness by the year 2020 known as Vision-2020. One of the five conditions of immediate priority is refractive error. Much of the refractive error in the community, even in developed countries is not fully, corrected<sup>21</sup>.

Early diagnosis and treatment of ametropias can minimize permanent loss of vision by amblyopia. Those at greater risks are children of preschool and school going ages. Screening programs in very young children would detect not only amblyopia itself but also other amblyogenic factors like ametropias, strabismus and visual stimulation defects, the diagnosis and treatment of which in time will prevent amblyopia and visual loss<sup>22</sup>. There is a very good old saying that goes like this-'a stitch in time saves nine'.

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