

ANISOMETROPIA*† ITS RELATION TO AMBLYOPIA AND ECCENTRIC FIXATION

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IN the refraction clinic the visual improvement cannot always be correlated with the degree of anisometropia. The literature shows that anisometropic amblyopia is a well-recognized condition, but opinions differ regarding the relationship between anisometropia and amblyopia. As the published studies do not consider the factor of eccentric fixation as a possible variable, we have investigated its relationship with anisometropia and amblyopia.

Methods and Material

212 cases of amblyopia associated with anisometropia of 0.5 dioptre or more were collected from the strabismus and amblyopia clinic at the Irwin Hospital, New Delhi. The fundus was normal in every case. The type of fixation was ascertained with the Visuscope, and the patients were divided into two groups: 118 with central fixation, and 94 with eccentric fixation.

Observations

Group 1. Central Fixation (118 Cases)

Table I shows that there is no direct correlation between the degree of anisometropia and the depth of amblyopia. Anisometropia of 0.5 to 1.0 dioptre is compatible with visual acuity from 6/6 to less than 6/60, and anisometropia up to 7 dioptres with visual acuity from 6/9 to less than 6/60; there is, however, a tendency for the visual acuity to be better in cases with a low degree of anisometropia.

TABLE I
RELATIONSHIP BETWEEN AMBLYOPIA AND ANISOMETROPIA IN 118 CASES OF AMBLYOPIA
WITH CENTRAL FIXATION

Visual Acuity	Anisometropia (dioptres)								Total
	0.5-1	1.25-2	2.25-3	3.25-4	4.25-5	5.25-6	6.25-7	More than 7	
6/6	24	4	—	—	—	—	—	—	28
6/9	7	8	2	1	—	—	—	1	19
6/12	4	2	—	2	1	1	—	—	10
6/18	5	4	1	2	2	2	—	—	16
6/24	3	3	2	2	1	2	—	—	13
6/36	5	2	1	5	1	—	1	1	16
6/60	—	—	—	—	2	—	—	—	2
Less than 6/60	1	—	2	2	3	3	1	2	14
Total	49	23	8	14	10	8	2	4	118

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Strabismus was present in 72 cases (34 convergent and 38 divergent). In 37 unilateral cases the degree and type of strabismus were unrelated to the visual acuity; the 35 cases of alternating strabismus had on the whole better visual acuity than those with unilateral strabismus (Table II).

TABLE II
RELATIONSHIP BETWEEN STRABISMUS AND AMBLYOPIA IN 118 CASES WITHOUT ECCENTRIC FIXATION

Corrected Visual Acuity	No Strabismus	Unilateral (37)			Alternating (35)		
		15° or Less	15-30°	30-45° or More	15° or Less	15-30°	30-45° or More
6/6	10	—	—	—	9	3	—
6/6 P	2	1	—	1	2	3	—
6/9	7	2	—	—	7	—	—
6/12	4	1	—	—	3	—	—
6/18	5	5	2	1	3	2	1
6/24	7	4	—	—	—	1	—
6/36	5	7	2	—	1	—	—
6/60	—	1	—	—	—	—	—
Less than 6/60	6	10	—	—	—	—	—
Total	46	31	4	2	25	9	1

Group II. Eccentric Fixation (94 cases)

Table III (opposite) shows that the vision is better if the fixation is nearer the fovea. Of the 25 patients with visual acuity from 6/9 to 6/18, seventeen had erratic fixation and eight parafoveal fixation. On the other hand, of the 32 patients with visual acuity below 6/60, only four had parafoveal fixation, the rest being paramacular, centrocaecal, or paracaecal. There was no correlation between the degree of anisometropia and the type of eccentric fixation.

Strabismus was present in 65 cases (41 convergent and 24 divergent). The degree of eccentric fixation was less in the 29 cases without strabismus, being erratic in nine, parafoveal in fifteen, and paramacular in five. The final visual acuity again depended on the type of fixation rather than on the presence or absence of strabismus.

Discussion

Lyle (1950) stated that "similar degrees of anisometropia and amblyopia tend to exist together". Helveston (1966) studied 57 cases of anisometropia but observed no correlation between anisometropia and depth of amblyopia. In our series the depth of amblyopia was found to correspond to the degree of eccentric fixation. This agrees with the views of von Noorden and Mackensen (1962) and Pasino (1962).

It thus appears that, apart from anisometropia and eccentric fixation, there exist other factors which determine the ultimate depth of amblyopia. One may be the age at which anisometropia is first manifested. Sorsby, Benjamin, Davey, Sheridan, and Tanner (1957) studied changes in axial length, refractive power, corneal and lens curvature, and depth of the anterior chamber. At birth the mean axial length of the eyeball is 17.9 mm., the cornea and lens are strongly curved, and the mean refractive error is 1.5 D hypermetropia. At the age of 3 years the axial length increases to 23 mm. and the refractive error is 2.0

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TABLE III
RELATIONSHIP BETWEEN AMBLYOPIA AND ANISOMETROPIA IN 94 CASES OF AMBLYOPIA
WITH ECCENTRIC FIXATION

Visual Acuity	Fixation	Anisometropia (dioptres)								Total
		0.5-1	1.25-2	2.25-3	3.25-4	4.25-5	5.25-6	6.25-7	More than 7	
6/9	Erratic	—	1	1	—	—	—	—	—	2
	PF	—	—	—	1	—	—	—	—	1
	PM	—	—	—	—	—	—	—	—	—
	CC	—	—	—	—	—	—	—	—	—
6/12	Erratic	2	—	—	—	1	—	—	—	3
	PF	2	—	—	—	—	—	—	—	2
	PM	—	—	—	—	—	—	—	—	—
	CC	—	—	—	—	—	—	—	—	—
6/18	Erratic	5	1	3	—	1	1	1	—	12
	PF	—	3	—	—	1	1	—	—	5
	PM	—	—	—	—	—	—	—	—	—
	CC	—	—	—	—	—	—	—	—	—
6/24	Erratic	1	3	—	—	—	—	—	—	4
	PF	1	2	1	2	—	—	—	—	6
	PM	—	1	—	—	—	—	—	—	1
	CC	—	—	—	—	—	—	—	—	—
6/36	Erratic	1	—	1	—	—	—	—	—	2
	PF	3	1	1	1	—	—	—	—	6
	PM	1	1	1	—	—	1	—	—	4
	CC	—	—	—	—	—	—	—	—	—
6/60	Erratic	—	—	—	—	—	1	—	—	1
	PF	1	—	—	2	1	—	1	2	7
	PM	1	—	—	—	2	1	—	—	4
	CC	—	—	—	—	—	—	1	1	2
Less than 6/60	Erratic	—	—	—	—	—	—	—	—	—
	PF	1	—	—	—	—	2	—	1	4
	PM	2	1	1	1	—	—	—	1	6
	CC	1	5	3	1	—	2	—	1	13
Total	PF	2	2	—	2	—	—	—	3	9
	PM	—	—	—	—	—	—	—	—	—
	CC	—	—	—	—	—	—	—	—	—
	PC	—	—	—	—	—	—	—	—	—
Total		24	21	12	10	6	9	3	9	94

PF = parafoveal
CC = centrocaecal

PM = paramacular
PC = paracaecal

dioptres of hypermetropia. From 3 to 14 years there is only 1 mm. increase in the axial length of the eyeball and this is accompanied by a slight flattening of the cornea and lens. Equal refractive power is, therefore, achieved by a delicate balance between refractive power and axial length. This balance may be upset at any age producing ametropia or anisometropia. When anisometropia manifests itself early, amblyopia is likely to be more dense than in cases in which it appears late.

Summary

(1) 212 cases of anisometropia were investigated for the degree of anisometropia, the visual acuity, and the type of eccentric fixation.

(2) The degree of anisometropia did not show any direct correlation with the type of eccentric fixation or the depth of amblyopia, but the latter was directly related to the degree of eccentricity.

(3) It appears that the ultimate depth of amblyopia may depend on the age at which anisometropia first manifests itself.

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