Refractive errors in patients with fundus flavimaculatus

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SUMMARY A total of 59 patients (118 eyes) with fundus flavimaculatus who had atrophic macular lesions were examined for refractive error. Myopic refractions of greater than -0.1 dioptre were seen in 12% of a normal population and in 76% of our patient population. The spherical equivalent refractive errors described a single-peaked skewed distribution with a mean of -1.12 dioptres, which is 2.12 dioptres more myopic than that of a normal population. In addition astigmatic refractive errors of greater than $+0.5$ dioptres were found in 42% of this patient population, which is considerably more than the 18.6% observed in a normal population.

It has been previously recognised that an increased incidence of myopic and astigmatic refractive errors is present in certain heritable chorioretinal diseases. In a study of patients with congenital stationary night blindness with clinically normal fundi Carr found 13 of 14 patients to be myopic, with spherical equivalent refractive errors ranging from -2.00 to -14.00 dioptres (mean, -6.00 dioptres).¹ In a study of 134 retinitis pigmentosa patients Sieving and Fishman found a predominance of myopic refractive errors.² In their group the mean spherical refractive error was -1.86 dioptres, which is 2.96 dioptres more myopic than the normal mean of $+1.00$ dioptre.³ Furthermore 74% of these retinitis pigmentosa patients had astigmatic errors greater than $+0.5$ dioptre² as compared with only 19% of a normal population.³ Krill noted that 80 to 90% of patients with gyrate atrophy of the choroid and retina have myopia to variable degrees.⁴ A similar increase in myopic and astigmatic refractive errors seemed to be present in patients with fundus flavimaculatus. To confirm this supposition we undertook a study of refractive errors in 59 patients with fundus flavimaculatus with associated atrophic macular lesions.

Patients and methods

Our study population consisted of 59 patients (118 eyes) with fundus flavimaculatus. All patients had an atrophic-like foveal lesion with either a ring or a more extensive garland of flecks within the posterior pole that extended to the equator in some instances. These cases have previously been described as stage I and stage II fundus flavimaculatus, respectively, by Fishman.⁵ Patients with stage I and stage II fundus flavimaculatus without atrophic macular lesions were not included. Also excluded were patients with more extensive retinal pigment epithelial or choriocapillaris disease, described as stage III and stage IV fundus flavimaculatus, respectively, by Fishman.⁵ In the latter group of patients there is more widespread atrophy of the retinal pigment epithelium and choriocapillaris, with extensive reabsorption of flecks, which makes the diagnosis of fundus flavimaculatus less apparent.

All refractive errors were obtained by manifest refraction. The majority were performed by one of the authors (D.D.); refractions from 3 patients were previously obtained by other physicians. The spherical refractive errors were calculated algebraically by adding one-half of the cylindrical correction to the spherical correction. Cylindrical refractive errors were measured and analysed in positive dioptres. None of the patients was aphakic.

Data on the refractive errors in the general

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Fig. 1 Spherical equivalent refractive errors from normal population compared with those of our fundus flavimaculatus patients.

population were taken from a study by Sorsby *et al.*,³ who sampled 1033 male National Service recruits in Great Britain in 1957 (aged 17 to 27 years). These authors included in their study a weighted addition of cases selected at random from a pool of men rejected from service because of high refractive errors. This study approaches an unbiased series of the general male population. A similar well controlled and unbiased series of the female population is unavailable.

Results

The spherical equivalent refractive errors for the 118 eyes studied ranged from +4.50 dioptres to -7.25 dioptres. The mean refractive error is 2.12 dioptres more myopic than the mean spherical equivalent

Table 1 Percentage distribution of spherical equivalent in study population (n=59)

Spherical equivalent (D)	OD, %	OS, %	Best eye, %
-8.0 to -7.1	1.7	1.7	1.7
-7.0 to -6.1	0	0	0
-6.0 to -5.1	0	0	0
-5.0 to -4.1	3.4	5.1	5.1
-4.0 to -3.1	6.8	6.8	8.5
-3.0 to -2.1	11.9	3.4	8.5
-2.0 to -1.1	25.4	22.0	25.4
-1.0 to -0.1	27.1	32.2	28.8
0 to +0.9	18.6	22.0	18.6
+1.0 to +1.9	3.4	5.1	1.7
+2.0 to +2.9	0	0	0
+3.0 to +3.9	1.7	0	1.7
+4.0 to +4.9	0	1.7	0

refractive error of a normal population (Fig. 1). Myopic refractions of greater than -0.1 dioptre were seen in 12% of a normal population³ and in 76% of our population. In addition there is a skew to the higher myopic refractive errors within the patient population. When the study group was subdivided into right, left, and best eyes (Table 1), a similar distribution was obtained. There was no statistical difference in the distribution of refractive errors between males and females. Furthermore there was no positive correlation between age and refractive error.

This study population also showed an increased incidence of cylindrical refractive errors. Cylindrical errors greater than +0.5 dioptre were found in 42% of the study population as compared with 19% of a normal population.

Discussion

Our analysis of refractive errors in patients with stage I and stage II fundus flavimaculatus with associated atrophic macular lesions showed a significant myopic shift of the mean spherical equivalent refractive error and a greater prevalence of astigmatic refractive errors, as compared with a normal population compiled by Sorsby *et al.*³

We note that Sorsby and coworkers derived their 'normal distribution' differently from that used for our fundus flavimaculatus population. For the 81% of their population who had cylinders less than or equal to +0.5 dioptre they used the same 'spherical equivalent' method as in our population. For the remaining 19% of their population, who had cylinders greater than +0.5 dioptre, they used the least ametropic meridian, a technique that understates the true spherical refractive error of the eye. Sorsby *et al.* found that astigmatic values greater than +0.5 dioptre were concentrated round the central spherical

values and were proportionally more frequent with hypermetropic than myopic refractions. Thus, if their spherical errors were converted entirely to spherical equivalent values, the mean of their data would be slightly more hypermetropic than is presented here.

The significance as well as the explanation of our findings remain uncertain. Rabin and coworkers⁶ have suggested from retrospective studies that an alteration in visual experience that disrupts pattern vision early in life, such as that which occurs in macular dystrophies, may result in a form of deprivation-induced myopia. Whether abnormalities in the cornea, lens, depth of the anterior chamber, or axial length of the globe singularly or combined are aetiological factors is yet to be determined. Such features are now being investigated in this population.

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