Some aspects of refractive errors in West Malaysia

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Introduction and Method

THIS PAPER IS an analysis of a survey of 500 cases of refraction conducted by the authors at the Eye Clinic of the University Hospital, University of Malaya, during a 2½-year period (Sept. 1967 to Feb. 1970). The age distribution in relation to spherical error; astigmatism and anisometropia would be analysed and the role of contact lens in these errors discussed. The age varied from 5 to 65. The data for the very young and beyond 65 are less valid because of the small number and often may be associated with pathological condition and hence excluded from this study. The vision had to be improved to at least to 6/9 in each eye to be included in the series. This is a study of hospital figures and does not claim to be representative of unselected population. With the problem of anisometropia, each eye is treated individually – hence 500 cases would give 1,000 eyes for the analysis.

Refractive errors were determined by retinoscopy. Cycloplegia was routinely used in children under the age of 10, in moderate hypermetropia and in difficult cases of refraction. Cross cylinder was used in subjective confirmation of astigmatism.

Results

Table I shows the age distribution in relation to refraction in the series as a whole – spherical refraction with half the astigmatic error added. The average mean error is calculated by algebraically adding the total error for each age group, divided by the number of eyes. **Fig. A** shows the distribution of cases in relation to age and **Fig. B** the average mean refraction in relation to age.

Table II shows the distribution of astigmatism – greater than 0.25D in relation to spherical error and **Fig. C** shows this graphically. **Table III** shows the distribution of astigmatism in percentage – 53% have no astigmatism or one less than 0.2D. **Table IV** shows the distribution of the axes of astigmatism for every 15 degrees and any stray was grouped with the nearest figure.

Table V shows the distribution of anisometropia – 152 cases ranging from 0.5 to 10.0D of which 0.5 to 1.0 makes up 93 cases.

Discussion

Age Distribution in relation to spherical errors. Table I and **Fig. A** show 11 – 25 age group predominates, with a peak between 16 – 20 (23.9%). This is not only because of schooling and employment that this group is refracted more often than others but because myopia has its greatest incidence and development during school years, it is also the period of growth.

TABLE I

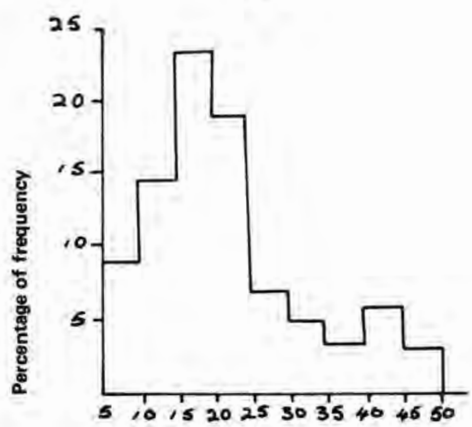
Age Distribution in relation to Refraction (Series as a whole)

Refraction	5–10	11–15	16–20	21–25	26–30	31–35	36–40	41–45	46–50	over 51	Percentage of Total
Greater than –10.1		1	6	4	1	1			1	3	1.7
–8.1 to –9.0	1	1	1	1							0.4
–7.1 to –8.0	3	6	8	5	3					2	2.7
–6.1 to –7.0	2	7	12	8	4	1	2	2	2	1	4.1
–5.1 to –6.0	2	6	16	12	6	3		1			4.6
–4.1 to –5.0	3	3	9	15	5	4		2		2	4.3
–3.1 to –4.0	8	13	21	13	3		2	4		2	6.6
–2.1 to –3.0	11	21	22	30	10	4	2	2		2	10.4
–1.1 to –2.0	16	31	60	38	22	15	3	5	4	6	20.0
–0.1 to –1.0	17	38	62	40	13	12	7	12	1	10	21.2
0.0 to +0.9	15	8	19	12	1	9	14	19	7	18	12.2
+1.0 to +1.9	4	4	2	2	2	1	7	9	10	40	8.1
+2.0 to +2.9	1	2			2			1	5	11	2.2
+3.0 to +3.9	1	1						2		4	0.8
+4.0 to +4.9	2		1	2	1			1			0.7
Total 1,000 eyes	86	142	239	182	73	50	37	60	30	101	100.0
Average Error	–1.5	–2.12	–2.36	–2.40	–2.16	–1.70	– 0.50	–0.43	00	+0.86	

The development of 1.0D of myopia would attract attention while a similar change in hypermetropia would pass unnoticed and this may partly contribute to the myopia excess in this series. European studies (Hirsh) show that the incidence of myopia increases markedly from 7 years to 18 – 20 and stabilises about 21 (Duke Elder). In this series (**Fig. B**) myopia commences at 5 (probably earlier) and continues to progress and reach a peak of –2.40D between 21 – 25 and then stabilises. This stabilisation is relatively delayed (by 5 years) when compared with the Caucasians. This is followed by a gradual shift towards emmetropia by the age of 45 and into low hypermetropia as the 50's are approached (+0.86D). In the Caucasian, there is an increase in the mean refractive state towards greater hypermetropia between 40 – 60 (Hirsh).

The ametropias of up to ±4.0D show essentially the same range of values as the emmetropic eye, so that the error present is not mainly the result of any unusual values, but a failure of correlation, especially between axial length and corneal power. Sorsby et al (1957) state that the eye, with an ocular refraction in excess of ±4D, fall outside the range of eyes with component that are observed in the emmetropic eye

Fig. A



Age distribution of cases

TABLE II

Astigmatism of 0.25D or more in relation to Spherical Refraction

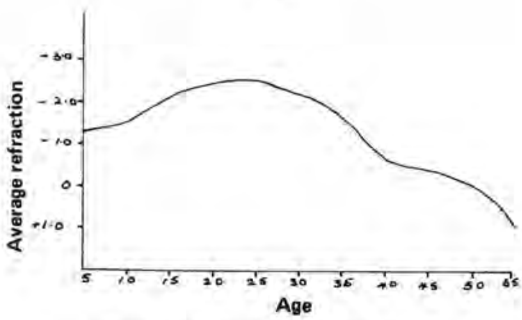
Spherical Refraction in the least ametropic meridin	Degree of Astigmatism (d)					Total Percentage
	0.25–0.5	0.6–1	1.1–2	2.1–3	3.1–4	
9.1 to –10			1			0.2
8.1 to –9.0	1					0.2
7.1 to –8.0	3	3				1.2
6.1 to –7.0	5	3	2	3		2.7
5.1 to –6.0	10	1	3			3.1
4.1 to –5.0	9	11	6			5.6
3.1 to 4.0	11	7			1	4.2
2.1 to 3.0	22	11	6	3	1	9.2
1.1 to 2.0	43	11	12	4		15.0
–0.1 to –1.0	85	48	20	5	2	34.2
0.0 to +0.9	48	26	9			17.6
+1.0 to 1.9	13	7	4			5.1
+2.0 to 2.9	1					0.2
+3.0 to 3.9	3	1		2		1.2
+4.0 to 4.9		1				0.2
TOTAL	254	130	63	17	4	100.0

TABLE III

Distribution of Astigmatism in Percentage

Degree of Astigmatism (d)	Percentage
0.0 or less than 0.25	53.8
0.3 to 0.5	25.4
0.6 to 1.0	13.0
1.1 to 2.0	6.3
2.1 to 3.0	1.7
3.1 to 4.0	0.4
TOTAL	100.0

Fig. B



Mean refractive status at various ages

and as such may perhaps be regarded as malformation of a pathological nature. In this series 17.8% of myopia **(Table I)** fall into the so-called pathological group. If the above criteria is to be used for the Malaysians, it would have to be modified with a myopia bias – probably –6.0D. Then the figure would be 7.9% which compares with 6.3% of Sorsby's 1960 series.

Astigmatism

Relationship to Spherical Errors

Table II, Fig. C show that most astigmatic errors are associated with spherical errors of a low order; +0.9 to –3.0 accounts for 77.0% with a peak between –0.1 to –1.0D (34.2%). Beyond this range, there is no correlation between these two errors. **Table III** shows 46.8% of cases have some degree of astigmatism. 0.25 – 0.5D accounts for 25.4% and errors greater than 0.6D for 21.4%. Most of the astigmatic errors of the low order (mainly less than 1D) unlike similar spherical errors often require correction – slight blurs are overcome by rapidly changing from one focus to another, thereby getting a composite picture utilising the clear component of each axes, this is fatiguing, it requires constant effort of accom-

TABLE IV

Axes of Astigmatism

Axes	15	30	45	60	75	90	105	120	135	150	165	180
No. of Eyes	24	23	13	11	20	127	16	5	15	7	30	176

TABLE V

Distribution of Anisometropia

Degree of Anisometropia	0.5	1.0	1.5	2.0	2.5	3.0	4.0	5.0	6.0	7.0	10.0
No. of Cases	59	34	15	8	8	9	6	5	3	3	2

modation. This is so when engaged in work requiring precise vision.

Areas of Astigmatism (Table IV)

The direct (with the rule) astigmatism is corrected by axes 180 ± 20 degrees accounts for 230, the indirect (against the rule) by axes 90 ± 20 degrees accounts for 163 and the oblique for 75.

For the same degree of error, the direct produces less blurring than indirect but the former accepts a full correction poorly but the latter accepts well (Sloane). As the direct produces less blurring, patients may delay seeking visual care.

Anisometropia (Table V)

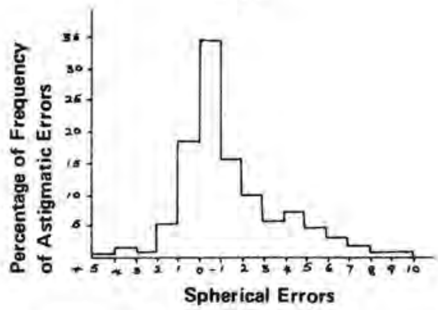
0.25D of difference causes a 0.5% difference in size of retinal image, a difference of 5% in the limit of tolerance in most cases (Whittington). Correction of 2.5D of anisometropia will render such patient monocular with glasses. There are 28 cases over 2.5D in this series. Since anisometropia is a predisposing factor towards amblyopia, strabismus may develop in the young (Sloane), hence an attempt is made to correct this. Corneal contact lens was advised for full correction to give best vision in each eye with binocular singular vision to meet the visual requirement of industry and different service fields. If the patient was unable to afford or tolerate contact lens, a compromise was resorted to by undercorrecting the more ametropic eye to achieve some degree of binocular vision.

Practical Aspects

In myopia, the concave lens is separated from the eye (+ ve) by air which creates an inverted Galiean telescope which minifies the image and this effect can be weakened by reducing the distance separating the –ve and +ve elements. A contact lens accomplishes this and gives the patient unaberrated peripheral vision, in addition to the larger retinal image. There is 8.7% of cases in this series over –6.0D who are ideal for contact lens. Contact lens for lesser errors are worn mainly for cosmetic purposes. A myope tolerates contact lens better than a hypermetrope as the images are minimised in the latter with contact lens.

Astigmatism can also be neutralised with contact lens with a better optical result. Errors greater than 3D causes the lens to 'rock back and forth' when fitted to the flatter corneal curve and produce blurring of vision (Gettes.) In this series, such error accounts for only 0.4%, therefore contact lens fitting poses no problem. From the myopic (over –6.0D),

Fig. C



Distribution of astigmatism in relation to spherical errors

astigmatic and anisometropic point of view contact lens gives good optical results. Fitting techniques are constantly being improved and with more people being encouraged to use, the ultimate cost of fitting would be reduced.

SUMMARY

Some aspects of refractive errors on 500 cases (1,000 eyes) from the University Hospital are analysed. Age distribution in relation to the spherical error; astigmatism, anisometropia and the role of contact lens in these errors are discussed. The 11 – 25 age group predominate with a peak between 16 – 20; partly because myopia coincides with this period of growth and partly the development of myopia would attract more attention than a similar hypermetropia in the schooling age group. This series show a myopic excess. In the Malaysian eye, myopia commences as early as 5 years (Caucasian 7 years) and stabilises around 25 (21 for Caucasian), with a peak average mean error of –2.40D. Sorsby et. al. (1957) view that refraction in excess of +4.0D be regarded as malformation of a pathological nature would have to be modified with a myopic bias probably –6.0D for the Malaysian eye, then the figure would be 7.9% which compares with 6.3% of Sorsby's 1960 series. Most of the astigmatic errors are associated with spherical errors of a low order +0.9 to –3.0D which accounts for 77.0%. The direct astigmatism accounts for 230, indirect for 163 and oblique for 75. Most of these low astigmatism, unlike similar spherical errors, require correction for constant precise vision. There were 152 cases of anisometropia of which 28 had a difference of over 2.5D. As this difference may render persons monocular and predispose to ambylopia, attempt is made to correct this with contact lens. The optical merits of contact lens for myopia over –6.0D (8.7%), astigmatism and anisometropia are discussed.

Acknowledgements

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