

AN ANALYSIS OF REFRACTIVE ERRORS IN SCHOOLCHILDREN*

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In the light of recent interest in the visual status of school-going children, it was thought that an investigation into the findings of one particular Cape Town clinic might be of interest. Accordingly an analysis was made of 4,453 school-going children, between the ages of 6 and 16, seen at the St. James Street clinic, Salt River, over a period of 7 years (1958 - 1965). These children were examined by 5 different ophthalmologists and allowances must be made for differences of opinion.

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Examination of all cases included inspection, ophthalmoscopy and retinoscopy, either with or without the exhibition of Atropine or Cyclogyl. Whenever possible, subjective tests were also used. It must be noted that all patients seen are indigent, belonging to the underprivileged stratum of society and must therefore be considered subject to the ills associated with poverty, malnutrition and ignorance; and as a result are less likely to report back for regular eye examinations than their more privileged counterparts. Also, no cases of obvious pathology were included in this survey.

TABLE I. CONSOLIDATED FIGURES

Age Group	Sex	Non-White						White						All Races
		Emm	My	Hy	As	Squint	Total	Emm	My	Hy	As	Squint	Total	
6-8	M	80	109	61	57	63	370	40	28	45	33	39	185	555
	F	99	151	88	114	78	530	35	31	61	38	31	196	726
9-11	M	136	134	58	76	40	444	38	36	39	19	22	154	598
	F	259	216	111	133	62	781	73	55	45	41	14	228	1,009
12-14	M	102	185	33	63	13	396	28	47	7	15	5	102	498
	F	181	186	57	105	34	563	38	56	17	34	6	151	714
15-16	M	21	69	9	16	—	115	4	20	4	4	2	34	149
	F	45	69	5	31	8	158	8	24	3	10	1	46	204
Total		923	1,119	422	595	298	3,357	264	297	221	194	120	1,096	4,453

FINDINGS

(1) Race

Of the 4,453 patients, 1,096 ($\pm 25\%$) were White. There were a few Asiatics, but the greater number of the remainder were Coloured¹ (i.e. belonging to an ethnic group including a mixed race of Hottentots, Malay, White and Bantu). No Bantu were seen.

(2) Age

An arbitrary division into age groups showed that 29% were aged 6-8 years, 26% were aged 9-11, 27% were aged 12-14 and 8% were 15-16 years old (respective numbers 1,281, 1,607, 2,212 and 353).

(3) Sex

1,800 (40%) were males and 2,653 (60%) females.

(4) Age and Sex

In the 6-8 year group, 43% were male, 57% female.

In the 9-11 year group, 37% were male, 63% female.

In the 12-14 year group, 41% were male, 59% female.

In the 15-16 year group, 42% were male, 58% female.

That is, in all age groups females predominate in an approximate ratio of 3:2.

(5) Refractive Errors

Cases were divided into 5 groups: (a) Emmetropes, (b) myopes, (c) hypermetropes, (d) astigmats, and (e) heterotropias.

(a) *Emmetropes*. 1,507 or approximately $\frac{1}{3}$ (34%) were emmetropes. Over subsequent years only 137 of these were seen on 2 or more occasions and 38 later received glasses mainly for mild myopia.

(b) *Myopes*. 1,416 or approximately $\frac{1}{3}$ (31.8%) were myopes. The majority had a low-grade myopia (i.e. less than -6.00DS), but 265 (or 19% of the myopes) had high grades of myopia² and 141 (or 10% of them) had more than 3 dioptres of anisometropia. As might have been expected, multiple visits over the years were common and an increase in the amount of myopia was also common, ranging from 1 to as much as 10 dioptres. There were cases that had as much as 18 dioptres difference in the 2 eyes, such differences of course being incompatible with binocular vision.

(c) *Hypermetropes*. 643 (or 14%) of the total were hypermetropic. The majority were low-grade³ (i.e. less than +4DS), but there were 101 (or 16%) of these hypermetropes with high grades of hypermetropia of up to 8, 9 and 10 dioptres. There were relatively few cases where there were more than 2.5 dioptres of hypermetropic difference in the 2

eyes. In those cases who have been seen on multiple occasions, most have shown no significant reduction of hypermetropia.

(d) *Astigmats*. This is a difficult term to define. We have considered a case astigmatic, if the only error is a cylindrical one without sphere, or where the spherical error has been insignificant in comparison with the cylindrical error. There were 789 (or 17.7%) of the total that fell within this definition of astigmats. Most were low-grade cylindrical errors (i.e. less than + or - 2.50 dioptres), but a third of them had more than + or - 2.50 dioptres of astigmatism ranging up to 8D.cyl. In the multiple-visit cases, very few showed any change in cylinder over the years.

(6) Phorias

While it must be impressed that this clinic is not intended to act as a centre for the discovery and treatment of squints, it serves a useful purpose because many squints are diagnosed here for the first time, and can be referred elsewhere for treatment and spectacles expeditiously provided. A total of 418 (or 9%) of squints were seen. Of these, rather more than half were hypermetropes. Many of the squints were obviously accommodative in nature, but among other diagnoses made were spasmus fixus, Duane's syndrome, and numerous V and A syndromes, as well as pathological conditions of the fundi and media as aetiological factors.

DISCUSSION

Patients seen are drawn from the indigent section of the community and environmental and economic factors may, therefore, result in the development of refractive conditions which will not be found in a comparable group of the well-to-do children who have the opportunity of earlier and more frequent examination by private practitioners.

Sloane and Rosenthal⁴ estimate that 20-30% of the 33 million children of school-going age in the USA suffer from visual defects that require professional care. We have no suggestions in this paper as to the investigation of this problem, at what age it should be carried out and by whom. There is no agreement as to what visual defect requires ophthalmological treatment.⁴⁻⁵

We have adopted the scale laid down by the Massachusetts Department of Public Health Vision Screening Test devised in 1940⁶⁻⁹ which lays down the following figures for disability requiring further investigation and probably treatment:

For grade 4-12, i.e. schoolchildren from Standard II to matriculation.

Visual acuity: less than 6/9 in 1 eye.

Hypermetropia: If 6/6 is read with a + 1.75DS lens.

Phorias: More than 2 degrees vertical, 6 degrees esopho-

ria for near and distance and exophoria of more than 4 degrees in distance and 8 degrees for near.

For grade 1-3, i.e. the Sub-standards and Standard 1.

Visual acuity: less than 6/12.

Hypermetropia: if 6/6 is read with + 2.25DS lens.

Phoria test: optional.

It is apparent that in the referral of the school cases the main reason has been because of poor visual acuity as tested by the school doctors and nurses on the Snellen's chart. We have frequently found that visual acuity recorded as less than 6/60, 6/60 or 6/36 is in fact a full 6/6. Other causes for referral are suspected squint or burning painful eyes, 'watering eyes' or dislike of strong light. Many have come because the school principal or teacher has found that the child's vision seems defective (or poor school progress is blamed on defective vision). Some have come direct. Other cases have been referred from Provincial hospitals where they have reported direct or are referred for refraction, having been treated for associated conditions such as squint or having now reached school-going age.

It is recommended that the school inspection should include the reading of Snellen's chart with a + 1.50DS lens in front of the eye which will screen certain hypermetropes requiring glasses. It is also suggested that a little patience in examination and a little attention to the detail of examination will result in less over-referrals. If $\frac{1}{3}$ of the cases seen by us do not need glasses because of emmetropia, this indicates excessive over-referral. We sometimes, of course, have to deal with a child (strangely enough usually female; strange because it is generally more difficult to persuade a girl to wear glasses) who wishes to wear glasses at any cost, whether it be through perverted vanity or as a 'status symbol', or perhaps a desire to look learned. It is further recommended that an orthorater¹⁰⁻¹³ be obtained by the Medical Inspectorate. This machine is quite portable and can be taken to the various schools and acts as a very useful screening device. This may exclude some of our 'emmetrope' cases, but may also reveal unsuspected refractive errors in other children of school clinic cases. We regret to report that there is no organized follow-up of the cases. We have invariably marked the card of every myopic case seen, to the effect that an annual re-examination is required. The clinic sister keeps a list and actually 'chases up' the children and their parents, but only a minority report back. They do so usually because the frames or lenses are broken or too small and, unlike private patients, seldom because the patient has noted that vision has deteriorated. They will do so if a school medical re-examination reveals the visual deterioration. We do not know how far the economic factor is important here, because though the patients are classified as indigent, the custom has been to levy a charge for spectacles, whether it be a few cents or as much as R2 as a discouragement to the frequent 'losing' of glasses.

It is disappointing to find that a high-grade myope, e.g. one with -6DS is only seen once and never again during his or her school career. It must be noted here, that in general probably only a minority of these schoolchildren stay at school after their sixteenth year.

With regard to squints, we encounter the same difficulty with regard to follow-ups. Occasionally the parents refuse point blank to take the child for further investigation or treatment. On the other hand, if referred, we do not know whether the child does in fact report to the Provincial hospital. We are also completely in the dark as to what operative procedures have been carried out, unless we have seen the cases in the hospitals ourselves. Likewise we are unaware of whether and what orthoptic treatment has been carried out or the functional result obtained. It is true that a number of cases find their way back to us, usually for repeat refraction and it may be found that the eyes are straight, or still strabismic or 1 eye is amblyopic. It should be remarked here that in general we see the children too late to expect full functional results. For full binocularity a squinting child should be treated before he gets to school.

In general our findings appear to have little in common with recent surveys such as Borishpoletz,¹⁴ who examined 941 school-going children, aged 7-14, and found impaired vision in 29%, 88% of whom had anomalies of refraction and 65% had myopia. McLaren,¹⁵ who compared the reference of Asiatic schoolchildren aged 6-12 in East Africa and India, found that 86% had refractive errors between 0 and 2D and only 2% had more than 2D. Eleven per cent were myopes of which only 1% had more than 4D. Mixed astigmatics totalled 6.6%. Anisometropia of more than 1D=8.6%.

SUMMARY

An analysis of the refractive errors of 4,453 schoolchildren examined at a school clinic is presented.

The cases have been divided into emmetropes, myopes, hypermetropes, astigmats, and squints, and have been analysed in terms of age and sex. A plea is made for the use of an orthorater or similar device for screening school children. At the least, a useful device (a + 1.50DS lens) should be employed by examining personnel in order to screen hypermetropes.

It is regretted that in general, the follow-up in the case of myopes and squints is so unsatisfactory.

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