Vision screening of adolescents and their use of glasses

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Summary and conclusions

Vision screening was performed in over 11 000 16-year-olds who were taking part in the National Child Development Study. For distance vision 75% had normal acuity, 9% a minor defect, and 16% a more severe unilateral or bilateral defect. For near vision 85% had normal vision, 8% a minor defect, and 7% a unilateral or bilateral defect. Few children (62) with normal distant vision had defects in near vision, though many more (607) had both poor distant vision and poor near vision. Vision defects were more common in girls than in boys and occurred more often in adolescents from non-manual than manual families. Although 18% of children had been prescribed glasses for current use, a third did not have their glasses available at the examination: 27% of the children prescribed glasses had normal unaided distant visual acuity or only a minor defect, and they constituted 42% of those who were not wearing their glasses.

Further investigation is needed into the criteria on which glasses are prescribed for children and into the reasons for which they are not worn.

Introduction

Information on the visual acuity of British schoolchildren is scarce. The results of vision screening at 7[1] and 11[2] in the children taking part in the National Child Development study (a longitudinal study of all children in England, Scotland, and Wales who were born in one week in March 1958[3]) have already been reported. We report here on visual acuity and the use of glasses in these children when they were aged 16, in their last year of compulsory schooling.

Method

Testing of distant and near vision was arranged by school medical officers. Distant visual acuity was assessed in 11 411 adolescents using a standard Snellen chart of block capital letters without serifs. The examiners were told to place the chart exactly 20 feet (6 metres) away from the child in a good light, level with the child's eyes, and free from glare. Each eye was tested separately, the other eye being occluded without pressure on the eyeball. Acuity was tested without glasses and then with glasses if they were available. Near vision was tested in 11 144 adolescents using a Sheridan-Gardiner card designed especially for the study.[3] The card was held no further from the eye than 10 inches (25 cm).

If glasses had been prescribed for use "at the present time" the examiners recorded whether they were available for the test. No inquiries were made about the use of contact lenses, but we assumed that few adolescents would have been wearing them in 1973.

To simplify the analysis the children were classified into six groups according to their visual acuity: normal vision—6/6 or better in both eyes; minor defect—6/6, 6/9 or 6/9, 6/9; unilateral moderate defect—6/6 or 6/9 in better eye, 6/12, 6/18 in other eye; unilateral severe defect—6/6 or 6/9 in better eye, 6/24 or worse in other eye; bilateral moderate defect—6/12 or 6/18 in better eye; bilateral severe defect—6/24 or worse in better eye. Similar groupings were made for near vision using the standard reduced Snellen nomenclature.

RESPONSE LEVELS

At the age of 16 some information was obtained on 87% of the 16 915 study children known still to be in the country and, except for a few minority groups, these were broadly representative of the total cohort.[4] Our sample was further reduced because only just over 11 400 (67%) of the total cohort attended a medical examination. Analysis showed that our sample of 16-year-olds was representative in terms of sex and social class. We checked for further bias in the sample by comparing: (*a*) the proportion in each unaided distant vision group at 11 among those tested at 16 and among those not tested at 16; (*b*) the vision at 7 among those with data at 16 and among those with no data at 16; (*c*) the vision at 16 among those with data at 11 and among those with no data at 11; (*d*) the vision at 16 among those with data at 7 and among those with no data at 7.

Results

ACUITY

Uncorrected distant visual acuity—Altogether 75% of the 16-year-olds screened had normal visual acuity of 6/6 in both eyes. Nine per cent had minor defects and the remainder moderate or severe visual impairment which was unilateral in 6% and bilateral in 10%. In 631 adolescents (6%) visual acuity without glasses was 6/24 or worse in the better eye (table I). Significantly more girls than boys had impaired vision ($P < 0.001$), this difference being accounted for by the higher proportion of girls with bilateral defects. Visual defects were also significantly commoner among adolescents from non-manual than from manual family backgrounds[5] ($P < 0.001$), and this social class difference was greatest among the group with severe bilateral visual impairment. A higher proportion of girls than boys had severe bilateral defects in both the non-manual and manual social class groupings.

Uncorrected near visual acuity—Over 85% of adolescents had normal near vision. Eight per cent had a minor defect in one or both eyes, and the remainder had moderate impairment which was unilateral in 4% and bilateral in 3%. Only 104 children (0·9%) had a severe bilateral defect of near vision.

Relation of distant to near vision—Table II shows that 83% of children had normal near and distant vision, or only minor defects (group A); 11% had only defects of distant vision (B); 1·5% had only defects of near vision (C); and 5·5% had defects of both near and distant vision (D). Only 62 (0·6%) children with normal distant vision had a moderate or severe defect of near vision in one or both eyes. But 607 (5·5%) children with defective distant vision (unilateral or bilateral) had near-vision defects. The four groups shown in table II were analysed by social class, and significantly more adolescents from non-manual families (14%) than from manual families (9%) had defects of only distant vision ($P < 0.001$), though social classes were equally represented among the other categories of visual impairment. A higher proportion of boys had normal near and distant vision ($P < 0.001$), whereas a significantly higher proportion of girls had impaired distant vision but satisfactory near vision ($P < 0.05$). More boys than girls ($P < 0.01$), however, had poor near and poor distant vision because of the higher proportion of boys with unilateral defects of near and distant vision. In contrast, similar proportions of boys and girls had defects of near vision only.

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PRESCRIPTION AND USE OF GLASSES

Glasses had been prescribed for current use for 18% of the 16-year-olds and for significantly more of the girls (21%) than of the boys (16%) ($P < 0.001$). Table III shows the unaided distant visual acuity of boys and girls prescribed glasses. There was no significant sex difference in the proportion of children with a visual defect prescribed glasses, but significantly more girls than boys with normal vision had glasses ($P < 0.001$). Overall, only a few children with 6/6, 6/6 vision had been prescribed glasses, but they did represent 15% of the children ordered glasses. Nearly a quarter of the boys and one in three of the girls who had been given glasses had an unaided visual acuity of 6/9 or better in both eyes.

Although there were no regional differences in visual acuity groups, or in glasses prescribed overall, significantly fewer ($P < 0.05$) glasses had been prescribed for adolescents with 6/6, 6/6 acuity in the north of England (2·4%) than in the other regions (3·8-4·5% in Scotland, Wales, southern England, and the Midlands).

A higher proportion of adolescents from non-manual than manual backgrounds had been prescribed glasses ($P < 0.001$), although differences were not significant for those with normal vision, a minor defect, or a severe bilateral defect (table III). The position was reversed in the group with moderate unilateral impairment, where proportionately more manual than non-manual children had been ordered glasses ($P < 0.05$).

A third of the adolescents who had been prescribed glasses did not have them available at the examination, and this applied equally to boys and girls. Overall, more children from manual than non-manual backgrounds had been prescribed but were not wearing their glasses ($P < 0.001$; table III). Over a quarter (28%) of glasses prescribed but not worn were for children with a visual acuity of 6/6, 6/6, and over half the children with normal vision or a minor defect who had been ordered glasses were without them. Even among the children with a severe bilateral defect 60 children (9%) did not carry glasses on their person and a further 10 children had not been prescribed them.

As children with satisfactory distant vision may have been prescribed glasses because they had impaired near vision, the uncorrected near visual acuity of children with normal distant vision who had been prescribed glasses was reviewed. Among these children who had their glasses available 18% had a definite unilateral or bilateral near-vision defect, but this applied to only 5% of those who were without their glasses.

We looked at the corrected visual acuity (near and distant) for children tested with and without glasses. Among 552 with severe bilateral impairment of distant vision 52 (9·4%) were poorly corrected (6/12 or worse in better eye) and 432 (78%) had an aided acuity of 6/9 or better in both eyes. The 90 children with severe bilateral impairment of near vision showed similar levels of improvement.

TABLE I—*Unaided distant visual acuity at 16 years*

Vision group	Better eye	Other eye	No (%) of children
Normal	6/6	6/6	8587 (75·3)
Minor defect	6/6	6/9	604 (8·5)
	6/9	6/9	361
Total			9552 (83·7)
Unilateral defect (moderate)	6/6 or 6/9	6/12	297 (2·6)
	,, ,, ,,	6/18	160 (1·4)
Total			457 (4·0)
Unilateral defect (severe)	6/6 or 6/9	6/24	100 (0·9)
	,, ,, ,,	6/36	95 (0·8)
	,, ,, ,,	6/60	45 (0·4)
	,, ,, ,,	<6/60	36 (0·3)
Total			276 (2·4)
Bilateral defect (moderate)	6/12	6/12	108
	,,	6/18	106
	,,	6/24	32 (2·5)
	,,	6/36	22
	,,	6/60	8
	,,	<6/60	4
	6/18	6/18	77
	,,	6/24	91
	,,	6/36	30 (1·9)
	,,	6/60	13
	,,	<6/60	4
Total			495 (4·3)
Bilateral defect	6/24	6/24	91
	,,	6/36	71 (1·7)
	,,	6/60	30
	,,	<6/60	1
	6/36	6/36	108
	,,	6/60	57 (1·5)
	,,	<6/60	10
	6/60	6/60	128 (1·4)
	,,	<6/60	33
	<6/60	<6/60	102 (0·9)
Total			631 (5·5)
Grand total			11 411 (100·0)

TABLE II—*Correlation between unaided near vision and unaided distant visual acuity at 16. Results are numbers (and percentages) of children tested*

Near vision	Distant vision: Normal	Minor defect	Unilateral defect	Bilateral defect	Total
Normal vision	7901 (71·4)	653 (5·9)	289 (2·6)	592 (5·4)	9435
Minor defect	373 (3·4) A	207 (1·9)	133 (1·2) B	167 (1·5)	880
Unilateral defect	31 (0·3)	50 (0·5)	245 (2·2)	113 (1·0)	439
Bilateral defect	31 (0·3) C	33 (0·3)	32 (0·3) D	217 (2·0)	313
Total	8336	943	699	1089	11 067

Discussion

Overall, our results in 16-year-olds are comparable to those of Douglas *et al*,[6] who found in a national sample of 3775 15-year-olds that 76% had normal vision (6/6, 6/6), 12% had an acuity of 6/9 in at least one eye, and 10% had a bilateral defect (6/12 or worse in better eye). As many as 12% of the NCDS children with normal vision at 11 years had a defect by age 16.[7] Impaired visual acuity at 11 was equally prevalent among boys and girls, but by 16 years more girls had visual impairment. The sex differences were particularly pronounced in the group with severe defects and may be accounted for by the suggestion that myopia is more common in girls than boys,[8] since there was a

TABLE III—*Glasses prescribed for current use according to visual acuity, sex, and social class*

Distant vision	No tested		No (%) prescribed glasses		No (%) of those prescribed glasses but not wearing them		No tested†		No (%) prescribed glasses		No (%) of those prescribed glasses but not wearing them	
	Boys	Girls	Boys	Girls	Boys	Girls	Non-manual	Manual	Non-manual	Manual	Non-manual	Manual
Normal	4158	3750	111 (2·7)	183 (4·9)	71 (64·0)	108 (59·0)	2233	4015	87 (3·9)	145 (3·6)	49 (56·3)	88 (60·7)
Minor defect	439	472	101 (23·0)	120 (25·4)	48 (47·5)	44 (36·7)	289	445	79 (27·3)	108 (24·3)	36 (45·6)	40 (37·0)
Unilateral defect:												
Moderate	225	217	135 (60·0)	128 (59·0)	57 (42·2)	60 (46·9)	147	200	79 (53·7)	132 (66·0)	26 (32·9)	67 (50·8)
Severe	148	117	85 (57·4)	77 (65·8)	35 (41·2)	27 (35·1)	68	135	51 (75·0)	77 (57·0)	12 (23·5)	29 (37·7)
Bilateral defect:												
Moderate	220	262	179 (81·4)	216 (82·4)	59 (33·0)	76 (35·1)	158	213	140 (88·6)	162 (76·1)	34 (24·3)	71 (43·8)
Severe	276	338	271 (98·2)	333 (98·5)	22 (8·1)	38 (11·4)	242	228	240 (99·2)	222 (97·4)	14 (5·8)	30 (13·5)
Total*	5466	5156	882 (16·1)	1057 (20·5)	292 (33·1)	353 (33·4)	3137	5236	676 (21·6)	846 (16·2)	171 (25·3)	331 (39·1)
Grand total	10 622		1939 (18·2)		645 (33·3)		8373		1522 (18·2)		502 (33·0)	

*We did not know whether glasses had been prescribed for 427 boys and 362 girls (of these 85% had normal visual acuity) or for 199 children from non-manual families and 396 from manual families (of these 83% had normal acuity).
†No male head, or father's occupation not known in 2452.

preponderance of girls with defects of distant vision only. Another aspect of the difference between boys and girls was illustrated by the higher proportion of boys with unilateral defects of near and distant vision. Although we cannot explain this, amblyopia associated with squint may be a factor. The preponderance of adolescents from non-manual families with poor vision was due to the group with defective distant vision but normal near vision. The likely explanation is again the higher occurrence of myopia in non-manual families.[6 9]

Glasses had been prescribed for 18% of adolescents, 6% more than at 11 years, but a third of this group did not have their glasses available at the medical examination. Few adolescents seeing 6/9 or better with both eyes would welcome glasses or, arguably, would need them for medical reasons, yet 27% of adolescents prescribed glasses had normal distant visual acuity or only a minor defect and only a few of this group had defects of near vision alone. This group constituted 42% of those who failed to produce their glasses at the examination. Interestingly, fewer children with normal acuity were prescribed glasses in the northern region than elsewhere and significantly more girls than boys with normal vision possessed glasses. Distant visual acuity itself is clearly no guide to what is considered to be a need for glasses although it may indicate whether the glasses will be worn. It might be argued that these adolescents would see better with their glasses—that is, 6/5, which we did not record—but if this is so user rejection seems to indicate it is not desired by large numbers.

Further investigation is needed into the criteria on which glasses are prescribed and into the reasons for rejection by large numbers.

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Controlled trial of plasma exchange in treatment of Raynaud's syndrome

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Summary and conclusions

Twenty-seven patients with Raynaud's syndrome had their digital vessel patency assessed by Doppler ultrasound after different thermal stresses. Digital vessel patency rates differed significantly after stresses at 15°C and 45°C. In a randomised controlled trial placebo and heparin had no effect either on patients' symptoms or on the patency of their digital vessels. Plasma exchange improved both symptoms and vessel patency rates at 15°C and 21°C. Improvement in seven out of eight of these patients has been maintained for six months.

Assessing digital vessel patency by Doppler techniques allows continuous, atraumatic, and safe evaluation of the effects of different methods of treatment on the patency of the digital vessels and has helped to indicate that plasma exchange is a useful adjunct in the management of patients with severe Raynaud's syndrome.

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Introduction

Most studies have indicated that the symptoms and signs arising from Raynaud's syndrome are secondary to intermittent obstruction of the digital artery.[1 2] This obstruction leads to a decrease in local tissue perfusion, which can be assessed by digital plethysmography.[3] Plethysmography, however, is not entirely accurate[4] and is difficult to apply to assessing individual digital segments. Previously vessel patency has been identified only by arteriography,[5] often performed under general anaesthesia.[6] We have been able to assess patency in the digital arteries of each finger from the web to the terminal phalange with a conventional doppler velocimeter.[7] Since plasma exchange has been reported to be beneficial in managing patients with severe Raynaud's syndrome,[8] we performed a prospective trial to compare the effects of a placebo, intermittent systemic heparinisation, and plasma exchange on the patency of the digital vessels in 27 patients with Raynaud's syndrome. We also used the technique to observe the effects of thermal stresses on digital vessel patency.

Patients and methods

Twenty-seven patients with Raynaud's syndrome unrelated to any proximal vascular lesion or trauma to the digital vessels were entered consecutively into the trial and were randomly allocated to one of three treatments groups: (*a*) placebo (nine patients), two tablets twice a day for four weeks; (*b*) intermittent heparinisation (nine patients), 3000 IU intravenously each week for four weeks; (*c*) plasma exchange (nine patients), 2·0-2·5 l/week for four weeks, 70-75% of total plasma being exchanged on each occasion. Of the nine patients in the plasma