A METHOD OF EXAMINING THE EYES OF SCHOOL-CHILDREN.

BASED ON THE STUDY OF THREE HUNDRED AND FIFTY-SIX BOYS IN THE WILLIAM PENN CHARTER SCHOOL.

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Threadbare as this subject may appear to anyone who, without special interest in it, has noted the appearance of hundreds of papers on the matter, and has, perhaps, been disgusted at the wide discrepancies of views and results which they too often reveal; it is, nevertheless, one of great importance to us, as citizens and ophthalmologists, and it is likely to demand more, rather than less, attention in the future. All its aspects have claims upon our interest and study, but many of them belong to the Section on Hygiene and State Medicine rather than to the Ophthalmic Section. I wish here and at this time, to formulate some views as to the methods of investigation which have been impressed on me as best by a dozen years of study, in the hope that any future investigators may profit, as they too rarely have in the past, by the experiences of their predecessors.

Few will question that the school should elicit and develop the mental aptitude of the scholar, revealing, and if possible, correcting his weak points; and the time is past when its relation to the physical condition can be neglected. Nor is it enough that *damage* to the individual during the educational process should be avoided—that the “overburdening of the scholars,” of which so much has been said, should be prevented from producing “school myopia,” scoliosis, or the many other ills more or less fairly laid to its charge. Physical education and development is demanded as a part of the school régime; and the scholar ought to be made a “better all-around man,” as well as mentally drilled for a special career, if he shows aptitude or has decided on one already. At the least, any disqualifying physical infirmity should be discovered, and opportunity given to remedy it or avoid its effects. Knowing that four per cent. of all boys are more or less color-blind, it is our duty to find out which are the unlucky ones and not leave them to discover it in some disastrous fashion. Time and again I have known candidates for the navy, who were exceptionally good scholars, possessed of splendid physique, coming long distances, and perhaps wasting much time and money in special preparation, only to be incontinently rejected as color blind, and sent home as completely discomfited as though they had been proved imbecile.

It is a matter for great congratulation that the subject of the physical education of the pupils in the schools is now receiving growing consideration. Most colleges have placed their gymnasias and athletic sports in the care of someone more or less fitted to restrain, as well as to promote, the exercises of the scholars. Scientific methods of physical examination and development have made increasingly good results possible; and in most of these institutions systematic exercise is reducing the number of the weaklings, guiding and controlling to good purpose those aspiring to be athletes, and, still more important, is raising greatly not only the standard of muscular strength, but also the good health and mental

capacity of the main body of the students. Similar results are being gained in the public and private schools, and will grow still more common as the advantages become more manifest and they vie with each other in their efforts to attract pupils.

Such a semi-annual physical examination, made in the William Penn Charter School of Philadelphia, last Autumn, furnished the results which form the text of my present paper. It was made by the Director of Physical Education as to all details of height, weight, girth of chest and limbs, and the dynamometer and spirometer results; and by a physician, Dr. Spenser Trotter, as to the medical aspects, such as the auscultation of the heart and lungs, and the condition of the eyes and ears. This latter part I undertook for him, as he was in doubt as to the best practicable methods; and it is in the belief that an account of it may be of value to others having such work to do, that I now make this report.

Every such examination is fraught with great difficulties. A certain number of parents will be found hostile to it, regarding it as an invasion of their American liberties and as prompted solely by sordid motives on the part of the examiner. Great prudence must be used in answering any of the questions, general or personal, which are asked by the scholars; and no report should be made, as a rule, except the official one to the school authorities. Much time and labor must be expended upon it, with the consciousness of having done useful and scientific work as the only reward; and the man who begins enthusiastically is apt to find the task very wearisome, and the sacrifice of time and energy a very severe one, before it reaches its close. For this reason a clear understanding of what should be learned, and a knowledge of the great shortcomings of the many examinations thus far made, are prerequisites to the undertaking. Too extensive a work should not be attempted; while on the other hand, although hundreds of thousands have already been examined, there is need for much further and better study, especially of small groups, repeatedly investigated.

My purpose was to obtain results that should be practically and scientifically valuable. Subjective tests, therefore, constituted but one part of the investigation; and, as time was an important question for all concerned, the methods to secure systematically full and accurate results were very important. A critical study of nearly every one of the two hundred or more examinations which have been made, and some previous experience in applying the ideas derived from them, as to what is desirable and practicable, have convinced me of the necessity of some tests, and the worthlessness of others commonly employed. The method pursued, closely similar to that used by Risley in 1879–80 and by myself in 1884, and now recommended, is as follows:

An accurate test card and astigmatic chart, such as Wallace's, are placed 6 meters away from the seat to be occupied by the pupil, well illuminated by an argand burner a half meter distant, which is hid from view by a black screen, perforated so as to give a point of light for muscle tests, and quartered with white lines to indicate the amount of any deviation found. Behind the pupil another argand burner furnishes light for tests of the near vision and for ophthalmoscopy and retinoscopy. The room is otherwise darkened by drawn shades. The Maddox prism or rod, a “prism mobile,” test glasses, Holmgren wor-

sted, ophthalmoscope, etc., must of course be within easy reach. Well-planned blank forms should be used for recording systematically and completely every result of the study; and much time and labor can be saved by a competent assistant, but most valuable as a mere clinical clerk, leaving all actual tests to the examiner himself.

Working upon this plan, the distant vision is first determined, each eye being screened in turn by a black card, and the subjective recognition of astigmatism tested upon the radiating lines, which should be the parallel bands of Green, not the simple radii. The muscular balance is then tried for the distant point of light, and any deviation measured by reference to the lines upon the screen or by the interposition of the prism mobile. The near vision for fine type, usually $D. = 25$, is then tried and the punctum proximum carefully noted, with the p. r. in myopia, etc. The Graefe test with a very fine dot-and-line, or the simple test which I have advocated (*Trans. Amer. Ophth. Soc.*, 1889, *Medical News*, September 7, 1889), of estimating the amount of movement of the eye from a position of rest under cover to that of fixation upon the fine object to which the fellow eye has been directed, will give prompt measure of any insufficiency of convergence, etc. The ophthalmoscope, in the upright image, gives the details of the eye-grounds, the condition of the media and the apparent refraction. The retinoscopy, with the plane mirror from 4 meters distance, gives delicate qualitative indication of the refraction, aided at need and made quantitative by a glass or two from the test case; and the test of distant vision, with any glass apparently required, or with that worn, often furnishes valuable data. The latter is quickly measured by neutralization, and when and how it was obtained learned by a question or two. A moment's use of the pen gives rude but valuable sketches of any anomalies of vessels, conus, etc.; the field can readily be taken in any case calling for it; the general and the ocular condition of health can be learned, with any note of inflammation of lids, conjunctiva or cornea, deviations of the eyes, apparent or actual, nystagmus, etc. A moment spent over the worsteds (on which each eye should be separately tested, and better by daylight), and unless the ophthalmometric measurements are desired, the examination may be terminated. In short, the entire examination usual in the office work of the careful specialist can be carried out; as it should be, if we are to learn the actual condition of the scholars' eyes—for every careful worker is aware that errors enough are possible even in the fullest and most scrupulously exact first study. Even when recording all these data myself, each examination could be completed in five minutes or less; and an expert observer, with a good clinical clerk, ought to be able to examine twenty or more in an hour.

As to the results of the examination, I shall shortly report elsewhere: it is sufficient to say that the results accord with those of my previous study of the eyes of medical students (*Trans. Pennsylvania State Medical Society*, 1885), and with the summarized results of all the previous investigations, as critically analyzed in my papers on "The Refraction of the Human Eye," *Amer. Jour. Med. Sciences*, July, 1885, and in the *Transactions International Ophthalmological Congress at Heidelberg* in 1888. There was a low percentage of emmetropia, few myopes, hyper-

metropic refraction predominated, and astigmatism was proved in nearly half the eyes. Color blindness was rare, being found in but nine cases, and there was only one case of retinitis pigmentosa; but a notable group of individuals was found where the conditions demanded prompt reference to their medical advisers for treatment of threatening disorders or the correction of serious optical defects.

SCHEME FOR RECORDING EXAMINATION.

School	Class	Date
No.	Name	Age
Condition of Health	Sex	
Condition of Eyes		
Distant Vision	O. D.	O. S.
Astigmatic Lines	O. D.	O. S.
Muscular Relation—Far		Near
Accommodation—Type	O. D.	O. S.
Color Perception	O. D.	O. S.
Refraction—Ophthalmoscope O. D.		O. S.
" Retinoscopy	O. D.	O. S.
Eye-ground—O. D.		O. S.

Dr. Samuel D. Risley, Philadelphia:—I would urge with Dr. Randall the importance of this thorough and careful examination if the work done is to be of any scientific value. I do not believe that the simple cursory testing of the sharpness of vision and the determination of the manifest refraction by glasses give results of any value when compared with the thorough work suggested by the author of the paper. Unless sufficient care is exercised to secure approximately accurate results the work is practically valueless.

Such careful work gives data from which can be obtained the relations of the different refractive conditions to the pathological changes which accompany them. I am glad that Dr. Randall has brought this subject to the attention of the session.

Dr. Francis Dowling, Cincinnati:—I have been much interested in this subject of the examination of the eyes of school children. Three years ago, I commenced a series of examinations in the schools of Cincinnati in order to determine the percentage of nearsightedness among the scholars. The great difficulty is to get the consent of the principals of the schools to put a mydriatic into the eyes of the pupils. In the cases that I examined, I arranged to go on Friday night and drop in the mydriatic so as to have the eyes in fair condition for study on Monday. There was almost a crusade against me for my work. I made a report to the school board, and the paper was referred to the committee on hygiene, and that was the last I heard of it. If we could get the members of the school boards interested, we could do a great deal of good. There are many evils in the way of light, position of the desks, etc., that could be remedied, and a great deal of trouble saved. In one school, the light was so bad that 73 per cent. of the children were nearsighted. I called the attention of the principal to it and he had the desks altered, but after he had given the order the school committee ordered the desks back again to the old position. That is the trouble in trying to get anything like a scientific result.

Among the German scholars I found uniformly about one-third more of near-sightedness than among the English speaking scholars. The German books seemed to be largely at fault in the production of this larger amount of near-sightedness. I suggested to the school board the advisability in the next contract for books, to have the books printed in the latin characters instead of the German. I got most of the German members to come to my view after showing that in Germany most of the text books are printed from latin type.

Dr. B. Alex. Randall, Philadelphia:—I doubt if any further words are needed, as I have probably said quite enough in regard to the general aspects of the question. I hold the belief that this investigating of eyes presumably normal, such as we find in school children, is almost the sole way of understanding what constitutes the usual, if not the strictly normal, refraction of the human eye. It is from the investigation of large numbers in some such fashion that we are to obtain our basis from which to deal with the whole question of the correction of refraction-errors and other conditions which we regard as evils, and to gain a comprehension of other more strictly hygienic questions of school influences upon the eyes of the pupils. But these things should be carried out primarily with the intention of directly helping, guarding and protecting the children under examina-

tion, removing if possible the faulty conditions under which they work and picking out those who are unable to stand the pressure which their fellows can safely bear. The school authorities must be furnished with the results; the detailed reports must be made to and for them alone, that, as in the case to which I have referred, the individual results of the examination may be sent to the parents and guardians for them to act on as they see fit. It is through the school authorities that the examinations are to be made and to be utilized. They must be in such form as not to interfere too much with the school work; but we must do our duty in such a way as to get results that will not be worthless and misleading. In none of these cases of color blindness, retinitis pigmentosa, or other serious lesion, or of large refraction errors even with low vision, had the conditions seemed recognized in a previous examination. This is the condition in a large proportion of these examinations; and I fear that it is often so even when undertaken by men professing to be ophthalmologists. I have shown that a fairly complete examination can be made in a period varying from three to five minutes, and I hope thus to remove the excuses for slipshod work and to make clearer the methods of meeting the requirements of these cases.

MANIFEST AND LATENT HYPEROPIA.

Read in the Section of Ophthalmology, at the Forty-third Annual Meeting of the American Medical Association, held in Detroit, Mich., June, 1892.

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It has frequently happened in the history of medicine that to clearly formulate an idea so that it could be practically applied in farther study, and especially in order to enforce it on the attention of others, it has been given more prominence and more definiteness than it really deserved. This I believe has happened with the conception of latent hyperopia. Unquestionably latent hyperopia exists very frequently. But it probably does not exist so frequently, and to the extent that might be inferred from much that is said about it.

For several years I have made it a rule to ascertain as accurately as possible the state of refraction before using a mydriatic, especially in what seemed to be cases of hyperopia almost, or completely free from astigmatism. From my last three years' records of errors of refraction I have sought out all those in which a record was made of the manifest and after the use of a mydriatic of the total hyperopia. The summary of these, including 214 eyes, is presented in the following table:

TABLE I.

Age.	Having no Latent H.	Having Latent H.	Per. cent of H. Latent.	Amount of H. Latent.
15	79%	21%	30%	0.70 D.
20	79	21	26	0.45
25	77	23	24	0.57
30	64	36	33	0.62
35	62½	37½	26	0.41
40	68	32	20	0.31
45	62½	37½	15	0.39
50	53	47	33	0.33

In the above table the first column gives the ages, the second gives the per cent. of eyes in which there was no latent hyperopia, the third column the percentage of cases in which a portion of the hyperopia was latent, the fourth column the average per cent. of the total hyperopia that was latent, in those cases in which any latent hyperopia existed; and the fifth column the average amount in dioptries of the latent hyperopia among those cases in which any portion of this hyperopia was latent.

Before discussing the rather startling facts that

this table reveals let us consider for a moment its relations to any similar investigation by other observers. So far as I know the observations most nearly comparable to these are those recorded by Daniels of Berlin (*Centralblatt für Prak. Augenheilkunde*, July-August 1883; and *Ophthalmic Review* Vol. ii, p. 300) based on the cases presented at Hirschberg's Clinic, measured ophthalmoscopically, most of them by Hirschberg himself. The points for comparison may be indicated by the following table:

TABLE II.

Age.	Proportion of the Total Hyperopia that is manifest.			
	One-third.	One-half.	Two-thirds to three-fourths.	All.
10 or under	85	10	5	
11 to 15	78	18	4	
16 to 20		76		24
21 to 25		68		32
26 to 30		14	62	24
31 to 35		11	63	26
36 to 40			28	72
41 to 45			13	87
46 to 50			5	95
Above 50				100

In this table the first column gives ages; the second indicates the percentage of cases in which the manifest hyperopia was not more than one-third of the total hyperopia; the third column gives the percentage in which the manifest was one-half the total hyperopia; the fourth column, the percentage in which the manifest was from two-thirds to three-fourths of the total; and the last column the percentage in which all the hyperopia was manifest.

Donders (*Accommodation and Refraction*, p. 239) thought that at twenty years about one-half the total hyperopia was manifest, at forty, more than three-fourths, and at fifty-five, latent hyperopia had ceased to exist. It is interesting to compare these earlier statements with the figures given in columns two, three, and four of table I. The discrepancy between them is startling, and in view of the high scientific attainments of the other observers demands explanation. The data upon which Donders founded his opinion are not given. The basis of Daniels' paper was a comparison of the hyperopia estimated by the direct ophthalmoscopic examination, which was assumed to be the total hyperopia, with the amount of manifest hyperopia estimated in the ordinary way. In view of my own experience I can only conclude that very inadequate means were taken to get the maximum of manifest hyperopia or that the estimates with the direct ophthalmoscopic examination were quite inaccurate, or that the cases examined were radically different from those we meet in Philadelphia. My own statistics are based on carefully ascertaining the amount of manifest hyperopia by repeated trials under the most favorable conditions, by the use of test-lenses and test-type at the range of four or six metres, taking the strongest convex lens that allowed the best distant vision as the measure of the manifest hyperopia. And taking the correcting lens as chosen under full mydriasis, and confirmed by the shadow-test and the direct ophthalmoscopic examination, as the measure of the total hyperopia.

A word as to the method of obtaining the maximum of manifest hyperopia. My method is to make the test after the approximate amount has been ascertained by the direct ophthalmoscopic examination. The eyes after being allowed a moment's rest have placed before them convex lenses strong enough to certainly over-correct the hyperopia. After find-