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(*Reprinted from the "Glasgow Medical Journal" for November, 1907.*)

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THE RELATIONSHIP OF MYOPIA TO SCHOOL WORK.[1]

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Early in last century James Ware[2] drew attention to the connection of myopia and school work in a communication which he read before the Philosophical Society of London. His views were apparently ignored, and ultimately forgotten, until Hermann Cohn[3] published the results of his investigations in 1867. An indefatigable worker until his death last autumn, it was largely owing to Cohn's labours that the subject of school hygiene originated.

Two years ago I undertook the examination of the eyesight of all the pupils in three of the schools of the Govan School Board. The investigation included the testing of the visual acuteness of each eye by Snellen's test types; the external condition of the eyes; and an ophthalmoscopic examination. The results were checked when necessary by retinoscopy, and homologated with the acuity tests. The complete details and the tabulated results are contained in a paper[4] published elsewhere. The tables were arranged according to age, and constructed from the number of eyes examined. One of the schools contained a large secondary department, filled for the most part with scholars who were working for the universities or training colleges. Some had attained the age of 18, while in the other two primary schools, the oldest pupils were

[1] Read at a meeting of the Glasgow Medico-Chirurgical Society held on 3rd May, 1907.

[2] Ware, *Philos. Trans.*, London, 1813, vol. i, p. 31.

[3] H. Cohn, *Untersuchungen der Augen von 10,060 Schulkindern nebst Vorschlagen zur Verbesserung den Augen nachteiligen Schul-Einrichtungen*, Leipzig, 1867.

[4] Pollock, *Trans. Roy. Philos. Soc. Glasgow*, 1906.

a few of 14 years of age. The former was situated in one of the healthiest and best residential districts of the city, and a certain number of the pupils came from the country. The other schools obtained their pupils from the superior working-classes and the small tradespeople. None of the schools were situated in the lowest districts of the city. I was able thus to avoid certain factors which might have led to erroneous conclusions; and to show, by tabulating the results from the three schools separately, that the etiology of myopia is practically independent of the status of the parents.

Age.	Number of Eyes Examined.	Myopic Eyes.	Per-centage.	Age.	Number of Eyes Examined.	Myopic Eyes.	Per-centage.
5	288	5	1·73	13	566	48	8·48
6	620	18	2·90	14	294	22	7·48
7	661	27	4·08	15	122	24	19·67
8	632	41	6·48	16	82	15	18·29
9	772	53	6·86	17	38	10	26·31
10	790	56	7·08	18	16	4	25·00
11	768	46	5·98				
12	697	51	7·31	Total,	6,364	421	6·61

The accompanying table is abstracted from the published tables. In it there is seen to be a regular and almost uninterruptedly progressive increase in the number of myopic eyes at each successive age-period. The increase is as distinct in the earlier as in the later ages, *i.e.*, in the primary as well as in the secondary departments. It will also be observed that myopia commences at the very beginning of school life. Unfortunately, I had not an opportunity of examining the children on their first admission to school, except in a few instances; in fact, the great majority of the pupils of five years had almost concluded their first year of school life at the time of the investigation. By arranging the myopic eyes in three groups according to the number of dioptres of myopia, it was clearly shown that the number of eyes with the higher degrees of myopia were absent at first, but commencing later they increased during school life. In other words, the majority of school children who become near-sighted show a continual increase in their myopia.

School statistics have been published from almost every civilised country giving similar results to my own. Finally, statistics obtained from the examination of young individuals in different trades, such as among the recruits for conscription

in France and Germany, prove that prolonged near work, provided it is commenced in youth, will lead to near sight; the more continuous the work, and the closer it is held to the eyes, the greater and the higher is the myopia. Children are not born myopic. The great majority of infants, as well as savages, are hypermetropic. During the first few years of life, however, a large proportion become emmetropic, or so-called normal-sighted. Myopia almost never originates in adult life, when continuous near work may produce pain, headaches, congestion, and the other symptoms of asthenopia or eye-strain, but not the changes associated with myopia.

Etiology.—It has thus been shown that myopia originates almost entirely during school life, and when once developed it is frequently progressive. At first, and in only the very lowest degrees, the myopia may be due to spasm of the accommodation, and so far it is amenable to treatment. An elongation of the antero-posterior axis of the globe nevertheless occurs early, and is permanent. It is the physical basis of the myopia, and, from the very origin, it is accompanied by structural pathological alterations in the tunics of the eyeball, although in the lower degrees such may be scarcely apparent.

There is considerable difference of opinion as to the manner in which this elongation of the eyeball develops. Congenital thinness or abnormal weakness of the sclerotic are old theories, and may be laid aside as insufficient to account for the facts. Diminution of the elastic fibres in the sclerotic is another theory that has been advanced, but refuted by later investigations. The shape of the orbit is a more recent theory which has obtained a large amount of support, and particularly from the work of Stilling.[1] He holds that with a low orbit, such as occurs in the broad type of face of the German, the Russian, the Japanese, and the Chinese, the tendon of the superior oblique muscle is abnormally low set. During convergence and looking downwards, as in reading, the tendon passes transversely across the eyeball, and, with slight continuous pressure, brings about the elongation of the sagittal diameter. He supports this contention by measurements in the living, numerous sections of the orbit in the cadaver, and *post-mortem* experiments. Various writers (Seggel[2] and others) have not been able to confirm these results, and the published statistics are contradictory. The most probable explanation is that the

[1] Stilling, *Zeitsch. f. Augenheilk.*, 1903, vol. ix, p. 1.
[2] Seggel, *Klin. Monatsbl. f. Augenheilk.*, 1904, vol. i, p. 244.

compression is brought about by all the extrinsic muscles acting together, while the tendon of the superior oblique plays the chief *rôle*.

The important point is that in the healthy eye myopia scarcely ever originates except during childhood and youth. For it is only then that increased intra-ocular pressure produces bulging of the tunics of the eyeball, as in buphthalmos. Thereafter the sclerotic has become too rigid and inelastic, so that in glaucoma the optic nerve entrance alone yields to the increased tension, where the lamina cribrosa is but a third of the thickness of the sclera.

Heredity is a predisposing factor, but it is quite common to find that the parents of myopic children are not themselves near-sighted. Conversely, where one or other parent is myopic, the offspring do not necessarily become so. In such cases it is always advisable to take greater precautions against the onset of myopia.

Hypermetropic astigmatism, and any factors causing a diminution of the visual acuteness, are of great etiological moment. This came out distinctly from my investigations. An illustration giving the various errors of refraction in percentage throughout school life showed a slight rise in the emmetropic curve. The myopic curve (the figures for which are given in the table accompanying this paper) also increased, and by a distinct step-like progression in the highest ages. The hypermetropic curve, on the other hand, constantly declined throughout the entire period. The point to be emphasised is, that by inversion it could have represented the myopic curve. Such but confirms what was already known. Hypermetropic astigmatism, under the pressure of near work, passes into mixed astigmatism, and ultimately becomes myopic astigmatism. We are thus given one of the most important indications for the prevention of myopia. Corneal nebulæ and congenital cataract frequently bring on myopia as a complication, the reason being that the imperfect vision urges the child to approximate objects to the eyes in order to obtain the larger retinal image.

Prophylaxis.—The prevention of myopia is one of the important branches, if not, as already indicated, the origin of school hygiene. It has given us the large, bright schoolrooms, and almost palatial buildings of the present day. The seats, desks, books and paper, blackboards, and all the other furnishings of the schoolroom, as well as the arrangement of the lessons, are all subject to the principles laid down by Cohn.

Here I would alone refer to the constant necessity of preventing the children peering into their reading and writing. The youngest are particularly prone to this fault. They will hold the slate or the paper as close as 5, 4, or even 3 inches to the eyes, and it requires constant watchfulness on the part of the parent or teacher to overcome the tendency.

The treatment of hypermetropia alone or combined with astigmatism, or of any defect of vision, should be undertaken as soon as possible after the commencement of school. Errors of refraction are not always detected by the test-types, especially when in the hands of the drill instructor, as in one of our schools. The London County Council have had six oculists. The Govan Parish School Board have appointed a number of medical men to undertake the regular inspection of the scholars, and this is to include the testing of the vision. The Glasgow School Board has appointed an oculist to go through each of their schools once a year. This is a valuable advance, and when the Government are able to pass a Scottish Education Bill, such an example will probably be followed in other districts. Each child should be seen on admission. An ophthalmoscopic examination must be included. Mere retinoscopy is insufficient, and unless the children are under a mydriatic, it may be very misleading. The examination should be repeated every three years, and the records are to be kept in a permanent form, so that they may be available during the remainder of the child's course, whether in the same or any other school. Myopic children should be re-examined each year.

With regard to glasses, in cases of hypermetropia or hypermetropic antigmatism, it is by no means always necessary for the child to wear the glasses constantly. If they are in use in the schoolroom it is often quite sufficient. Mothers appreciate this for their daughters, while it allows the boys to engage in various games and sports. For myopia it is essential that the correct glasses be prescribed. It cannot be too often repeated that the myopic eye is a diseased eye. I have seen in one afternoon at the clinic in the Eye Infirmary three cases of permanent blindness due to separation of the retina. Each of the patients was at the prime of life, or rather under it. They were between 30 and 45 years of age. Several writers uphold the view that there are two distinct conditions included in the term myopia. They say that the ordinary low form never passes into the malignant type. On the other hand, the opposite opinion is held by the great majority of specialists, and particularly by men who, in a long and rich

experience, have observed the actual development of the one from the other.

Progressive cases of myopia require, therefore, constant supervision. The posture during lessons, the type of their books, and, in special cases, a desk for home lessons are valuable. These may be obtained at a moderate cost, and when that is prohibitive, reading slopes, as the "Erectnek," may be employed.

Attention must also be directed to the general health. Exercises of all kinds are valuable, especially when performed as a break in the course of lessons. Out-door sports are to be encouraged among studious children.

GLASGOW: PRINTED BY ALEX. MACDOUGALL.