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THE PREVENTIVE TREATMENT OF MYOPIA INCLUDING THE USE OF THE TELEOPTO READING LENS

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THE writer, as chairman of the Eyesight Conservation Committee of the New York City Optometrical Society, has for a number of years made a study of eyesight conservation and lectured to parents, teachers and children on the care of the eyes. While engaged in this work he realized that though many children born with normal eyes, acquired optical anomalies before they reached maturity, little or nothing was being done to prevent the acquirement of these defects. As the visual errors manifested themselves, school authorities referred the children for refraction and the prescription of lenses, to compensate for the optical defect. In myopic cases especially, the optical error would continue to grow and the child would, at regular intervals, require a change to stronger lenses, to care for the increased myopia. However, this was not due to a lack of study of the problem of myopia as from time to time during the past one hundred years, various oculists and optometrists have brought forward systems of eye exercises, appliances for holding the head, the incorporation of prisms in the correction lenses, bifocals and reduced lenses for reading and the use of cycloplegics and other drugs. However, none of these techniques had been generally adopted by the eye professions. Nonetheless, the writer felt that the problem of acquired myopia could be solved.

As is commonly known, the anatomical structure of the human eye is roughly similar to a camera. Rays from a distant object, enter it parallel and are focused on the retina in back of the eye. However, it has been proven by dissection that in myopia the retina or film of the eye is situated beyond the normal focal plane and the image of an object falling on that retina is therefore distorted by blur circles.

Myopia may be divided into three principal types—(1) the simple myopia in its two stages: (2) the high degrees of progressive myopia due to changes in the coats of the eyeball; (3) the myopia caused by refractive changes, such as in diabetes, incipient cataract and other eye diseases. It is only the first type which embraces the great majority of the cases which we are concerned with in this paper.

Civilized man has suffered from myopia for hundreds of years. The ancient Greeks described it as that condition in which near objects are clearly defined but not distant ones. Very likely the ancient Hebrew and Chinese scholars likewise suffered from myopia, on account of their intensive study and their hardly legible writing. In all ages up to the present the scholars and learned men were easy prey to the ravages of nearsightedness. However, prior to the last few hundred years the greater

part of the population was immune from this ailment as reading and writing was the exception rather than the rule.

In recent generations with the almost universal elimination of illiteracy and the adoption of the eyes to the demands of modern manufacturing processes, myopia is no longer limited to scholars but can be found in every intellectual strata of our people.

At one time the wearing of spectacles was a sign of superior intelligence. The wide prevalence of myopia and other eye defects has made this theory passe.

For millions of years the human race used their eyes almost entirely for distant vision. The eyes were used principally as an aid in locomotion, the warning of the approach of friend or foe and a means in the search for food. None of these requirements entailed the use of the eyes for close vision. Comparatively few years ago most of our ancestors lived from the soil and were required only very rarely to apply their eyes to distances less than three or four feet. The greatest amount of close work some of them did was at the dinner table, which was not much of a strain at that.

With the sudden change from distant to close work within a few generations, it is remarkable that myopia is not a great deal more prevalent than it is. We can be thankful for this to the marvelous toughness and resistance of the sclera. However, a sudden change in the application of this or any other organ of the body produces stress and strain with its resultant disturbances. The long hours of school work, and perhaps music lessons, are abnormal uses of the delicate eyes of children for which they are not at present adapted, the result being that those children whose eyeballs are not quite as resistant as some of their brothers' succumb to the ravages of close application of the eye. As further evidence of the effect of civilization on the eyes, we find that in a number of surveys of uncivilized savages there was a total absence of myopia.

On the other hand, everyone is aware that a considerable proportion of our population are wearers of minus lenses.

Königstein, Ulrich, Schleich and Herrnheiser found no cases of myopia among 3,200 eyes of newly-born children. Herrnheiser only met with one solitary case among 1,820 newly-born children examined by the direct method under atropin. Up to the age of six there is practically no myopia. It can be thus seen that myopia is an ailment acquired in later years.

Herman Cohn of Breslau examined 10,000 school children and found in the elementary schools 1.4% myopic (these German schools comprised only the first few years), the intermediate schools 10% and in the Gymnasia 26%. These figures were later verified by 200,000 more examinations. We must therefore come to the conclusion that myopia increased with increased application to close work, rising with each year of school life.

While there are a number of theories as to the cause of nearsight, it is almost generally agreed that close eye work is the greatest factor. Tscherning in examining 7,000 young Danish conscripts further brought out the influence of near work on myopia in his survey. He found that of the total number of myopes 93% were persons employed doing near work and 7% were laborers and agriculturists. Thirty-two per cent were

students, 16% employed in offices and trade, 13% artists, 12% tailors, shoemakers, etc., laborers 5%, peasants or farmers 2%. However, the greater amount of education and literacy in this country has raised the amount of myopia in the laboring classes as well. It is thus most evident that near work is one of the principal factors in the cause of myopia.

Thomas Hall Shastid, in his paper, "The Evolution of Eyes," expressed the belief that the effects of accommodation and convergence in near work were so serious that eventually through evolution the eyes will come closer and closer until in the far distant future man will become a cyclops with two maculae and a negative accommodation. We are sure Shastid failed to reckon with the advances of modern optometry. The teleopto type lenses described further in this paper will obviate any need for worry along these lines.

The view has also been expressed that myopia is a harmless and useful adaption of the eye to its new environment. I disagree with this view. The human race has not given up the need for distance vision. The conquest of space by airplane, fast autos and trains has increased rather than decreased the need for clear binocular vision. Man must be able to see far ahead to direct the new speedy means of travel. He must have a highly developed stereoscopic sense in order to judge distances and sizes of far away objects. With the modern airplane as a most potent weapon of war a nation of myopes even corrected by glasses would be at a disadvantage. One cannot shoot at a target he cannot see, nor drop a bomb at an object whose distance he cannot judge. We optometrists must save the children of this nation from the insidious inroads of nearsightedness.

The most successful treatment for myopia has been the application of hygienic laws to the use of the eyes and the elimination of all application to close work. This can best be epitomized by a quotation from Dana's famous sea story, "Two Years Before the Mast": "I had undertaken a two or three years voyage from a determination to cure if possible by an entire change of life and by a long absence from books and study a weakness of the eyes which had obliged me to give up my pursuits and which no medical aid seemed likely to cure."

The writer has, after seven years of clinical research, refined his technique for myopes and incipient myopes to the following procedure: The patient is refracted as usual, care being taken not to overcorrect. The patient is then fitted with a pair of plain teleopto lenses in a trial frame for about fifteen minutes, with instructions to read a bit and also look about him in the room. This will relax some of the excessive accommodation that may be present. These are fitted over his previous Rx if he has one. The patient's refraction is again checked. The optometrist then determines from his patient's occupation his range of close visual work. For example, if the patient is a student, this range would not necessarily be his reading distance of 33 cm., but the furthest distance at which reading and other close work can be comfortably held, a distance of about 45 cm. with an addition 5 millimeters allowance to permit him to look at objects around his desk. With this taken as his working distance there is then calculated the lens which placed before the eye would make parallel, rays

of light emanating from the working plane, thus eliminating the necessity for accommodative effort for seeing at that particular distance.

f = focal length of lens in meters.
F = refractive power of lens in diopters.
u = distance of objects from lens in meters.

$$F = \frac{1}{f} = \frac{1}{u}$$

For rays of light originating at distance u to emanate parallel from lens, then f will equal u. This is then added to distance prescription previously found.

Then the examiner taking the same working distance calculates the prisms which would make parallel in direction, in the horizontal plane, rays of light, emanating from the working plane, permitting singular binocular vision of objects at the working distance without any effort of convergence on the part of the eyes.

u = distance of object from lens in meters.
P = total power of right and left prisms in prism diopters.
p = pupillary distance in centimeters.

$$P = \frac{1}{u} \times p$$

This is usually divided equally between both eyes therefore prism power before each eye will be $\frac{P}{2}$ Base In.

This prism element is then added to the spherical and cylindrical lenses previously determined.

For purposes of optometric nomenclature lenses consisting of spherical and/or cylindrical and prismatic elements combined in such manner as to obviate accommodation and convergence in seeing at the distance for which they were prescribed, we call teleopto reading lenses. Tele for distance, opto for eye, because the wearer of these lenses has his eyes in almost the same state as if he were looking at distance when applied to close work. The teleopto lens is the first prophylactic ophthalmic lens designed expressly for the prevention of an optical defect, rather than the relief of an existing one.

Teleopto lenses are to be worn when doing any close work. Inasmuch as distance vision is blurred with these lenses and the patient will see distant objects double they cannot be worn for that purpose, and the patient should be so advised. Also, patients may find on certain occasions that they do not have time to change to the teleopto lenses for reading. For example, when called upon to read a few lines in the classroom or to glance at a price tag in a store. On such occasions we do not require the patient to put on teleopto lenses. The momentary reading of close print without the teleopto lenses gives the convergence and accommodation occasional use which is not undesirable. Bifocal teleoptos may be prescribed for school and other outside use, but the single glass is necessary for home use and extended close work.

Teleopto lenses are also to be worn by the patient at meal times. The purpose of this being relaxation of the accommodative and convergence functions.

The patient is instructed to wear the teleopto lenses as directed for one week. During this week the patient comes to the office for daily exercises. These are an assortment of prism base in exercises which might include the stereoscopic technique, rotary prisms from 33cm. to 10 feet or stationary prisms with the blinking or flashing technique, rotating discs or moving lights. The purpose of these base in exercises being to accustom the patient to the teleopto lenses and relax the accommodation as much as possible.

After taking these exercises and wearing the teleopto lenses as directed for one week the eyes are again refracted. The prescription found at this time is fitted for constant wear. Very frequently this will be found to be a reduction from the first refraction. Also, in many low cases of myopia the excessive accommodative type, the need for distance lenses has been eliminated.

The patient is then instructed to continue conscientious use of the teleopto lenses as previously directed. There is then instituted a new series of exercises. The purpose of these exercises is to relieve any tension of the extrinsic muscles. Practically all of these cases being exophores, base out prism exercises are given according to the technique of Arneson, or using a stereoscope or rotary prisms, or stationary prisms with the blinking, flashing or rotating exercises. After completion of the base out exercises some base in should be given at the end of the visit. Also, it should be noted that the base out exercises would tend to influence the relationship between the accommodation and convergence so that the convergence impulse would be ahead of the accommodative impulse tending to relieve excess accommodation. The extent of these exercises depends on judgment of the optometrist. Also, patient should return occasionally for observation and further exercises if needed.

However, accommodation and convergence is not all there is to be considered as causing myopia. Infraduction and the effect of the pressure of the oblique muscles must also be relieved. Many authorities believe that the pressure of the oblique muscles on the outlets of the venae vorticosae cause gorging of the veins in the bulb of the eye with resultant hydrostatic pressure and stretching of tissues. In addition the wearing of teleopto lenses for reading it is important that the patient hold his reading matter at an angle of about fifteen degrees below his eye level and tilt it back about twenty degrees and as far from the eyes as possible with sufficient illumination coming over the left shoulder. The patient should of course be instructed never to read in a reclining position or bending over. In reading with teleopto lenses hold reading matter far out and bring in gradually until print is clear.

At all times after reading with or without teleopto lenses patient should exercise his eyes in the following manner: describing an arc like the rainbow going back and forth through the upper semi-circle, each time bringing the eye as high and as far to the right and left as possible.

While theoretically the eye is relaxed when using teleopto lenses there

is yet a certain amount of effort being expended. It is therefore suggested that the patient look up from his close work into the distance at intervals of fifteen minutes.

The maintainance of good general physical condition through exercise, fresh air, and proper diet is essential. Proper diet especially in regard to vitamin and calcium to give the correct or sufficient toughness to the connective tissues. In passing we must note that certain vitamins are essential for the action of the visual purple in the retina. Good retinal function will help eliminate the necessity for holding things close to the eyes. In the above matters the patient is referred to his physician.

We thus have eliminated the principal causes of myopia and have still permitted the patient to attend to his daily tasks. We have removed accommodation, removed convergence, removed infraduction, removed the torsion that goes with these and have provided practically effortless seeing at near as well as distance. Ordinary myopia does not develop under these conditions.

In evaluating the results of a number of cases for whom teleopto lenses were prescribed we may take as a yardstick the results of a myopic survey made by the London Public Health Service in which there was found that there was an average increase in myopia in boys –0.47 diopters per year; girls, –0.59 diopters per year, and in one case there was a decrease in myopia. The writer in twenty-two cases over eighty-seven case years observed an average decrease in myopia of –0.02 diopters per year. Numerous cases of simple over-accommodative myopia in which no lenses were prescribed are not included in above figures.

However, it should be noted that there is included above three cases in which there was an increase in myopia. However, the writer feels the myopic increase would have been greater had not the teleopto lenses been worn. Practically all of the patients for whom teleopto lenses were prescribed submitted their eyes to constant study in public school, high school, college and office and considering this the results have been very satisfactory.

The writer feels that with the patients under observation and control throughout the day the results would have been even more effective.

The writer believes that he can conservatively say that 80% of myopia can be prevented through the use of teleopto lenses and the other recommended measures. Therefore, every effort should be made to discover those children who are becoming myopic, at the threshold before they have advanced to a measurable degree. Children should be examined every six months by an optometrist with a skiascope from five years of age on. In addition, in the intervals between, the children should have their visual acuity taken on the test chart by the teacher once a month. At the first signs of myopia proper treatment should immediately be instituted before any serious inroads have occurred as in slight degrees the visual acuity can still usually be brought to normal without the aid of spectacles for distant vision.

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