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Can Headaches and Asthenopia, Resulting from Hyperopia, be Relieved Without Glasses?

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Can Headaches and Asthenopia, Resulting from Hyperopia, be Relieved Without Glasses?

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The query propounded in the title of this paper would probably be answered in the negative by a very large majority of all oculists of to-day, and even but a short while ago the writer would also have responded "no"; but in the light of present knowledge and experience we believe that in a great many instances it can be done. I am also prepared to go still further, and make the assertion that, in my opinion, even the correction with glasses of what is understood as manifest hyperopia, in cases associated with exophoria, will, in many instances result in no permanent relief, but rather, ultimately, in positive harm. Furthermore, in cases of hyperopia in which convex glasses are necessary, we believe that, as a rule, proper discrimination as to the strength of the glasses required is *not* made, and as a result some cases are given too strong a glass and others too weak.

I do not wish to be understood as making the claim that *no* case of hyperopia needs glasses, or that *all* cases of headaches in hyperopic patients can be cured without glasses, but simply desire to point out a new factor, which, in my opinion, renders the need of glasses unnecessary in many cases that have heretofore been considered as demanding their use; and further, that those cases in which the necessity of glasses still seems to be imperative, that improper glasses may be prescribed from a lack of careful examinations as to the condition of the recti muscles.

The foregoing opinion is based upon the careful study of over 200 cases of errors of refraction, occurring in my private practice during the past year, together with the associated conditions of the extrinsic muscles of the eye, as shown by the phorometer.

The loss of the normal equilibrium of the ocular muscles, heterophoria, is now admitted by nearly all oculists to be a potent factor in the causation of headaches and asthenopia.

Of the several forms of heterophoria, but one variety will be especially considered as bearing principally upon the subject of this paper, viz., exophoria, or a deviation of the visual lines outward. This condition must necessarily be due to either a weakness of the internal recti muscles, to a preponderance of strength of the external recti, or to both combined. As esophoria will also be referred to in this article, we would say that it is a condition directly opposite to exophoria, or a deviation of the visual lines inward, due either to a weakness of the external recti, to increased strength of the internal, or to both combined. It is the accepted theory that, as a rule, either of the above conditions is usually due to a weakness of one muscle, rather than to increased strength of its opposing muscle.

My attention was first directly attracted to the relation existing between the external and internal recti muscles and hyperopia by the following case:

Case I.—Dr. H., æt. forty-four, came to me in July, 1888, with the following history: Has been wearing glasses for the past six years, having first noticed his eyes causing him trouble while engaged at the close work of his profession, dentistry. He then consulted a prominent oculist of this city, who prescribed a weak convex glass for near work. This glass seemed to give him relief for a time, but after a while the old symptoms returned, and by advice of his physician he began using a stronger glass, with the same result—temporary relief, with, later, a return of his symptoms.

After some while his eyes began to trouble him for distant vision, and he was ordered weak convex glasses for distant vision,

with a similiar relief of the discomfort of the eyes, followed later by a return of the distress and an accompanying increase in the strength of his glasses.

Thus a change in his glasses had been made a number of times during the preceding six years until, when he came to me, he was wearing convex 30 for distant vision and convex 18 for near vision. At this time he was nearly incapacitated for work, from a tired, strained feeling of the eyes on continued application, with an almost constant, heavy, confused feeling of head, smarting and itching of the eyes and eyelids, photophobia, and a generally run down feeling.

Examination revealed vision $\frac{1}{1}\frac{5}{0}$ o.u. Hm. $\frac{1}{60}$ V. $\frac{1}{1}\frac{5}{0}$ o.u. He could read $\frac{1}{1}\frac{5}{0}$ with a convex 30 glass, but it was clearer with the 60. The doctor was told that his glasses were too strong, and upon my advice they were reduced to a 60 for distance and 20 for near vision.

In April, 1889, Dr. H. returned, reporting that his eyes had been much better for several months but of late were beginning to trouble him again. At this visit an examination of the muscles revealed an exophoria of 1° and exophoria in accommodation of 3°, with an adduction of 22° in each eye. Systematic exercise with prisms to strengthen the internal recti was advised, and followed out faithfully, until an adduction of 48° in each eye was obtained, with a considerable improvement in the comfort of his eyes. At this point the phorometer showed orthophoria at distance, but an esophoria in accommodation of 8°, with an abduction of 8°. Thinking then that we were overdoing the exercise of the inner muscles, because the phorometer showed a deviation of the visual lines inward, I thought it advisable to try and strengthen the outer muscles by exercise with prisms in order to correct the esophoria. This was followed out for over two months, until an abduction of 12° was reached and the esophoria reduced to 4°, but, all the time we were exercising the outer muscles, the eyes and head felt very much worse, and we were evidently making no progress toward the cure of his eye strain. Then, upon one examination, a test of his muscles was made with his glasses on, and the mystery was at once solved ; for it was found that, while he had orthophoria at a distance without his glasses, with the convex 60, which he was wearing, there was an exophoria of 1°; and in accommodation, while there was an esophoria of 4°

without his glasses, with the convex 20, he was using, there was an exophoria of 6°.

The use of all glasses at a distance was now stopped, and for near work they were reduced to a 24 ; systematic exercise, with prisms of the internal recti was again commenced and followed out until, in December, 1889, he had reached an adduction of 72° in each eye, which he still maintains.

The phorometer at this time shows orthophoria at a distance and esophoria of 3° in accommodation, but with the convex 60 glass he is now wearing for near vision, there is orthophoria in accommodation.

Outside of the use of glasses and prisms he has had, from time to time, various remedies and electricity used, but none of these have been employed at all regularly.

The strength of his glasses for all near work has been successively reduced, so that he is now wearing a convex 60 glass for near vision and none for distance. His eye and head symptoms have disappeared gradually under the treatment, and his general health has very much improved over what it was at the time he was first seen in 1888.

This case has been detailed at length on account of its peculiar course, and as an illustration of the pernicious results from the use of too strong glasses.

First. We find a case which would be generally considered by all oculists, at the time his eyes were first troubling him, as requiring glasses, and the gradual increase in their strength as was followed would have probably been the treatment of nearly all ; and yet we find the eyes steadily growing worse from their use.

Second. It demonstrates the necessity of examining the muscular condition, both with and without the glasses, which correct the refractive error, and that the treatment should depend upon the condition existing when the eyes are prepared for work, that is, with the glasses they are to use.

Third. The permanent relief found after a course of training of the ocular muscles together with the steady reduction in the strength of the glasses used.

Fourth. The fact that after the strength of the internal recti muscles has been increased from 22° to 72°, we find a gentleman, now forty-six years of age, whose manifest hyperopia is 60, and who was over two years ago wearing a +18 for near vision, now wearing with perfect comfort a convex 60 glass for near work; in other words, making no correction of the presbyopia.

One fact demonstrated in this case, viz., that in this patient a convex 20 glass would convert an esophoria of 4° in accommodation into an exophoria of 6°, or an equivalent to changing an orthophoria in accommodation to an exophoria of 10°, led me to note the result of glasses in other cases, and I found that in many cases of hyperopia with esophoria, we could correct the esophoria by the use of convex glasses, as for example:

CASE II.—Miss G., æt. thirty-six years, came to me June 14, 1890, complaining of almost continuous headaches for the preceding two months, usually on top of head or at the occiput. She thought the headaches were somewhat worse upon use of the eyes at near work. Examination showed vision $\frac{1}{1}\frac{6}{8}$ o.u. No Hm. Orthophoria at distance, esophoria in accommodation 4°, abduction 8°, Convex 72 glass gave orthophoria in accommodation. This glass was then prescribed for near vision and at once gave relief of her headaches, which have not returned up to the present time.

The prescription of a convex glass in this case was made simply because there existed esophoria in accommodation, and was given to relieve the undue convergence of the internal rectus muscle. The benefit to be gained from the use of glasses in hyperopia with esophoria was first shown by Dr. George S. Norton, in THE JOURNAL OF OPHTHALMOLOGY, OTOLOGY, AND LARYNGOLOGY, vol. II., No. I, in which he formulates the most excellent rule: "*In manifest hyperopia with esophoria give stronger glasses than in the same degree of manifest hyperopia with exophoria*, for one can depend upon there being a higher degree of latent hyperopia in the former than in the latter."

One more case in illustration will be all that I shall detail, although many others could be taken from my case records in demonstration of the points it is desired to make, but, as they would prove merely a repetition of the features detailed in these, it is not considered necessary.

Case III.—Miss H., æt. twenty years, was recommended to me on February 27, of this year, for an obstinate blepharitis, which had existed for a year or more; edges of the lids were covered with dry scales and crusts, with, at some points, small pustules, from which exuded sufficient discharge to cause an agglutination of the lids each morning. On reading, eyes ached and felt tired and the lids became inflamed.

Had been subject to occasional headaches for years. Examination gave V. $\frac{6}{6}$ o.u. Hm. $\frac{1}{12}$ V. $\frac{6}{9}$ o.u., exophoria 2°, exophoria in accommodation 10°; with convex 72 there was exophoria in accommodation of 14°, adduction 16° each eye.

She was told that she did not require glasses, and that exercise with prisms would relieve her.

This was followed out for about two months on an average of twice each week, when she was discharged with the inflammation of the lids entirely healed; no headaches, vision $\frac{6}{9}$ o.u. and not benefited with glasses; orthophoria both for distance and in accommodation.

In this case I believe that the majority of oculists, finding a case of obstinate blepharitis, with a manifest hyperopia of 72, would have at once ordered glasses for near vision at least. At all events, I should have done so previous to my discovery that convex glasses would increase exophoria, as it would have done in this case, with, I believe, an ultimately increased and permanent weakness of the already weakened internal recti.

Now, as to the rationale of this treatment, Donders has pointed out that the function of accommodation and convergence is associated in such a way that, for a given degree of convergence, there is always a nearly equal degree of accommodation, and *vice versa*. This relation is perhaps due to the fact that the muscles of accommodation and convergence both receive the same nerve impulse, as the

action of each muscle is governed by a branch of the same nerve, viz., the third pair, or oculomotorius. The most anterior filaments of this nerve arising from the floor of the third ventricle, supply the ciliary muscle, while the filaments of the nerve arising from the *iter e tertio ad quartum ventriculum* go to supply the internal rectus muscle. Landolt, in his "Refraction and Accommodation of the Eye," says, "that a continued effort of the ciliary muscle is practicable only when it calls for but two-thirds, or at the utmost, three-fourths of the total power of accommodation," and, on the other hand, "that the quota of convergence, which can be utilized for continuous work, ought not to amount to more than one-third or even one-fourth of the positive convergence power; hence, that two-thirds or three-fourths of the latter should be kept in reserve."

The ciliary muscle is composed of three sets of fibers; the meridional, running parallel to the sclerotic; the circular, forming a ring parallel to the cornea; and the radiating fibers. Iwanoff has shown that, in certain myopic eyes, the circular fibers may be entirely lacking, and, on the contrary, in hyperopic eyes are so highly developed, that they form one-third of the ciliary muscle.

As to the action of this muscle Heinrich Müller ascribes a different action to each set of fibers:

1. "The circular fibers of the ciliary muscle exert a pressure upon the edge of the lens, by means of which the latter becomes thicker."

2. "The longitudinal fibers of the muscle cause an increase of tension in the vitreous humor, on account of which the posterior surface of the lens is prevented from shifting, and the action of the peripheral pressure is chiefly confined to the anterior surface"; and also, that, "The arching forward of the center of the anterior surface of the lens is rendered possible and favored by the recession of the peripheral portion of the iris, which is accompanied by a contraction of the deeper (circular) layer of the ciliary muscle and the iris." Thus we see that the circular fibers of the

ciliary muscle are the ones by which the act of accommodation is chiefly caused, and, further, that these circular fibers are especially developed in hyperopic eyes.

These facts should be considered in connection with the fact that hyperopes require a much greater accommodation than myopes who have little or no need of it.

To summarize a little we have first found that there is a positive relation between accommodation and convergence; second, that at the utmost there is but one-third of the power of accommodation held in reserve, while, on the contrary, there is at least two-thirds of the power of convergence remaining unused; and third, that the act of accommodation is especially required in hyperopic eyes.

Now, the query arises, Why is it not right to assume that, by increasing the power of convergence, we can relieve the strain upon the accommodation, with its resulting asthenopic symptoms and headaches? This theory, to my mind, is supported by the fact that when we put on a convex glass in hyperopia, with exophoria, or a weakened power of convergence, we cause a greater exophoria with a diminished incentive to convergence, and thereby diminish the power to converge, with the result that the more delicate ciliary muscle, with but a small fraction of its full power still left unused, is called upon to perform a certain portion of the work of its much stronger associate muscle, the internal rectus, and thus, by increasing the demand upon an already weakened muscle, I believe serious harm may be done.

Experience has demonstrated that, by systematic exercise, we can increase the strength of any of the voluntary muscles of the body. The internal rectus muscle is a voluntary muscle, and its power can certainly be increased by exercise, but the ciliary muscle is an involuntary muscle, and it is, so far as I know, beyond our power to increase its strength; but as the action of these two muscles bear a fixed and definite relation to each other, is it not sound reasoning to believe that, by increasing the power of the one we can reach, we are benefiting both?

Hyperopia is a congenital defect of the eye, and generally attributed to an imperfect development. Landolt states that in children, under eight years of age, hyperopia is the rule. The preponderance of hyperopia in the eyes of the newly born has been shown by the examinations of Ely (*Archives of Ophthalmology*, vol. ix., p. 29), who found, from the examination of 100 eyes of children under eight weeks of age, that emmetropia was present in 17, myopia in 11, and hyperopia in 72.

Now, as hyperopia is seen to exist from birth, and as we all know that the headaches and asthenopic symptoms do not come on as a rule, in these cases, until from the eighth to the twentieth year, or until the child has reached the period of life when from his studies there is an unusual requirement made upon the accommodation, we may safely attribute the cause to either accommodative or muscular asthenopia, i.e., a weakness of either the ciliary or the internal rectus muscle, or both combined.

We have seen that these two muscles may be considered as working together, and we may, therefore, draw the conclusion that by increasing the power of either the ciliary or the internal rectus, or both, we are going to relieve the symptoms resulting from the strain upon either, and, in this way, by removing the symptoms for which the use of glasses is generally advised, we will avoid the necessity of glasses in these cases of a low degree of hyperopia. I say the low degrees of hyperopia because there is, of course, a limit to the possibilities of increasing the power of any muscle, and and my limited experience in this direction will not warrant even a suggestion as to the limit of the degree of hyperopia in which we can forego the use of glasses.

We will now turn to a brief consideration of another condition, viz., presbyopia, which is simply a recession of the near point, due, according to some authorities, to a decrease of the accommodation, and by others to a change in the lens by which it becomes more firm, and in consequence of this increased consolidation, the same amount of muscular action cannot produce the same change on the form of the

lens as formerly. The writer is inclined to believe it to be due, at least partially, or in some cases, to a decrease in the power of accommodation, because we will often find the degree of presbyopia varying very materially in persons of the same age and of the same refraction; this, we believe depending upon the use made of the accommodation by various individuals; as, for example, the farmer, in his occupation, does not make the same use of his accommodation as the book-keeper.

Therefore, if presbyopia is the result of decreased power of the accommodation, why will not the treatment to increase the strength of the internal recti, or the power of convergence, so as to perform in part the work of the ciliary muscle, thereby reserve a greater power of the accommodation to a later period, and in this way postpone the age at which presbyopia would set in?

I make no claims as to having discovered an elixir of life, but merely offer a suggestion as to a possible method of postponing, to a moderate degree of course, the onset of old age in so far as it applies to the presbyopic changes of the eye.

All of the preceding portions of this article refers to cases of hyperopia in which there exists exophoria. If, however, we have hyperopia with esophoria, as in the second case reported, my experience leads me to believe that the use of glasses is imperative, and I have found that in the majority of cases we can correct the esophoria by use of the convex glass, and it has been my custom to prescribe the glass which corrects, or nearly so, the esophoria; and this will usually be the glass that represents the manifest hyperopia, or a little stronger one, and should be used continuously. In some cases, in which the esophoria is of a high degree, the convex glass necessary to correct the esophoria will be too strong to be worn with comfort, when we should only approach as near as possible to a correction and yet give comfort and clear vision to the patient. If presbyopia exists with hyperopia, and we have an esophoria in accommodation greater than that at a

distance, a much stronger glass (sufficient to correct the esophoria in accommodation) is given for near vision.

To conclude, the following deductions may be drawn :

1. Always examine the muscular deviation with and without the correcting lenses, as convex glasses will increase exophoria and decrease esophoria.

2. If exophoria exists with hyperopia, always prescribe the weakest glass possible or none at all.

3. If esophoria is found with hyperopia, prescribe the glass that corrects the esophoria, or as nearly so as possible.