Reprinted from Northwest Medicine, Seattle
Vol. XXVIII, No. 1, Page 29, January, 1929

HEADACHE AND EYESTRAIN*

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In any practice of ophthalmology probably the most frequently expressed complaint, next to defects in vision, is headache. In the more recent years, since the services of the ophthalmologist have been called upon to a greater extent, the problem of headache from eyestrain becomes an ever increasing one. I refer exclusively in this paper to the headache caused by what is known as eyestrain, which in itself may mean many things but is looked upon generally as the fatigue, caused by poor vision or some defect in the neuromuscular mechanism of the eyes. Headaches from other causes, such as intracranial pressure, inflammatory conditions of the eyes, inflammations of the optic nerve, glaucoma and other conditions in which there is definite pathology present, will not be dealt with. It naturally follows that any ophthalmologist has a large experience on which to base a knowledge of headache from the clinical point of view. However, it does not mean that we know much about it. Headache, for obvious reasons, has not been studied by analytic laboratory methods, so that we must content ourselves with superficial conclusions.

It was S. Wier Mitchell, as quoted by Langdon, who made the first conclusive statements regarding

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*Read before the Portland City and County Medical Society, Portland, Ore., April 18, 1928.

eyestrain as a cause of headache. This was published in 1876 in the *American Journal of Medical Sciences* and was convincing enough to arouse general medical interest. Mitchell's statements were these: That there are many headaches which are due to disorders of the refraction or accomodation apparatus of the eye; that in those instances the brain symptoms are often the most prominent and sometimes the sole prominent symptoms of the eye trouble and that, while there may be no pain or sense of fatigue, the strain with which it is used may be interpreted solely by frontal or occipital headache; that the long continuance of eye troubles may be the unsuspected source of insomnia, vertigo, nausea and general failing health; that in many cases the eye troubles become suddenly mischievous, owing to the failure of the general health or to increased sensitiveness of the brain from moral or mental causes. These brief paragraphs contain the gist of our knowledge of eyestrain today. Since that time whole libraries have been written on the subject but little if any new thought added.

Headache, as you all know, is pain felt in the dural branches of the trigeminus, the dural branches of the upper cervicles and the recurrent dural branches of the vagus. The trigeminus is by far the most important. If you will pardon a brief anatomic description, I will recall to your minds that the centers of the third, fourth, fifth, sixth and seventh cranial nerves form a closely related group, all interconnected, and that the fifth is the sensory nerve for the area supplied by the others as motor nerves. It is, therefor, in the reflex arc of these four nerves, three of which are motor

nerves for the ocular muscles. There is also communicating branches from its ophthamlic division to the ocular motor muscles.

By far the most important cause of habitual headache is eyestrain and by this, as I have said before, is meant the strain or fatigue of the adjusting mechanism of the eye. It is not a strain of the retina or the sensory apparatus, strain of which does not cause pain. It produces only diminished or altered vision. This, however, may in turn cause added effort to be made by the adjusting mechanisms, thereby producing eyestrain, but the strain originally is not of the sensory mechanism.

There are two adjusting mechanisms of the eye. First is the focusing mechanism which produces the sharp, clear-cut image of the object looked at, and the second is the fixation mechanism which enables the two eyes to look simultaneously at an object and to maintain the visual axes in such a position that the image of the object falls exactly on the macula of each eye. If the focus of the light falling from an object is not an exact focus, then an effort must be made to remedy the condition and there takes place reflexly an adjustment of the lens by a complicated nervous mechanism controlling the ciliary muscle, either a contraction or relaxation of that muscle to enable the light to be focused exactly. This is known as accomodation and is a factor which is working continuously during all the waking hours. If the two eyes are not able simultaneously to fix upon an object, then there is loss of binocular single vision. Diplopia results with all its distressing symptoms. This mechanism of fixation and binocular single vision includes the muscles

moving the eyes and especially the motor nerve cells below the third and fourth ventricles with their elaborate system of intercommunication and coordination, not only with each other but with visual, auditory and other centers often concerned in ocular movements.

It is by means of these two mechanisms that one is able, on the one hand, to overcome many of the commonest errors of refraction and secure in spite of these errors good vision and, on the other hand, to correct minor defects of the ocular muscle balance and secure binocular single vision. The demands made upon these mechanisms in the normal individual are not great, certainly nowhere near the maximum strength of the individual muscles, for, as is true throughout the human body, all structures are built to withstand more than the ordinary load. Lancaster has pointed this out to show that eyestrain is not universal. However, as he says, and it is true, especially in our own city, there are certain enthusiasts (I refer to the refracting opticians or so-called optometrists), nonmedical men, who would have the public believe that everyone is in need of glasses to prevent terrible things happening to their vision; and, on the other hand, are the pure fakirs, who take off the glasses of everyone whom they can entice into their so-called institutes, and treat everything with optic atrophy to cross eyes with various colored lights and eye exercises.

When the work to be done is well within the limits of endurance, no strain results, but there are several conditions under which the limit is reached and symptoms of eyestrain result. First, the presence of an error of refraction. This causes

the eyes to make an adjustment of the focusing mechanism, in addition to the ordinary focusing for the distance of the work. The effort may be because of the magnitude of the error or because it necessitates a more exact and trying adjustment. Second, the print may be poor or the lighting defective or unsteady, and the eyes are whipped up to more perfect adjustment, resulting in strain. Third, conditions which lower the tone of the neuromuscular mechanism. These include all debilitating conditions, sinus disease and practically anything which will lower the general body tone. Remember, however, that there are great variations not only in the power of different individuals but also at different times and under different conditions in the power of the same individual. An error of refraction or a muscle imbalance in one individual will cause no symptoms, while in another with perhaps not quite so stable a make-up, much discomfort will be the result.

The ferreting out of a reason or reasons for headache from the standpoint of the ophthalmologist requires a thorough history of the condition and a most careful examination of all the ocular structures, particularly the two mechanisms referred to. It is evident that the frequency with which the eyes are proven to be the cause of headache will depend upon the completeness of the ocular examination, the correct interpretation of the findings and the proper carrying out of the treatment. Many patients are able to identify their headaches as definitely related to the use of the eyes, yet there are many whose first symptom is "stomach trouble." Some have headaches following shopping tours, rid-

ing in street cars, trains, automobiles, etc., yet these invariably have normal vision or very close to normal. I wish to impress that it is not, as a rule, the individual with the gross visual disturbance that complains of the headache but rather the one who always sees well both for distance and near vision.

The first essential in an examination of the eyes in an obscure headache problem is a very exact and careful examination of the refraction. This is of the utmost importance and cannot be occomplished satisfactorily without the aid of a cycloplegic drug, certainly not in any one under the age of forty-five or in any one of whatever age, whose accommodation is at all active. Holding the accommodation in abeyance not only permits one to gain accurate knowledge of the state of the refraction of the particular eye, but not infrequently will bring to light a hidden muscle imbalance, one which was masked by the aid of the accomodation but held so at the expense of considerable nervous energy. The eyes must be put at rest, if one is to uncover the low grade oblique astigmatism, for I believe that in no other way can it be discovered. If there were no such thing as astigmatism, probably most refractions could be done without the use of a cycloplegic and at the same time there would probably be very few ocular headaches. It takes time to be sure, and there is a certain slight inconvenience to the patient, but the results more than compensate for the effort.

The layman has become confused by the propaganda of the nonmedical eyesight specialists regarding the use of "drops," and I dare say that many of the medical profession feel the same way, if one can judge by the frequency with which medical men

refer patients to the refracting optician for glasses. In doing so they apparently forget that the examination of the ocular mechanisms is as much a medical affair as that of any other part of the body. And certainly the frequency with which eyes have been blinded by the failure of nonmedical men to recognise disease is sufficient reason in itself to urge patients to have their eyes examined by those medically trained.

I wish here to call your attention to two cases seen in the past few months, both patients having previously been under the treatment of optometrists. One had lost the central vision of one eye and the fellow eye was failing rapidly. Examination revealed a marked retinitis with numerous hemorrhages throughout both fundi. An examination by an internist revealed the fact that the patient was suffering from diabetes. This patient was wearing a pair of dark blue glasses, when she came to my office, one of many pairs which had been prescribed.

The second patient was partially blind in one eye, with the visual field reduced to an extremely narrow periphery and failing vision in the other eye. Examination revealed a very marked retinochoroiditis, specific in origin. Wassermann four plus. This patient had been treated by colored lights in one of our so-called eye institutes.

The careful correction of the refractive error, found when the eyes are under the influence of the cycloplegic, by the wearing of glasses, especially the full correction of any astigmatic error, not infrequently produces a very beneficial effect on the patient's distressing symptom of headache. And as I have stated before, the error need not be a gross

one. Frequently there is little if any change in the visual acuity with or without glasses, but the patient is benefited. As an example, I will cite a case in which the vision of each eye was normal.

A man, 39 years of age, robust and physically active complained of "bilious attacks," tightening in the back of the neck and invariably a week-end sick headache. There was no disturbance of the neuromuscular mechanism, except a markedly diminished convergence. Under profound cycloplegia, a very low grade oblique astigmatism was found. This correction was prescribed, to be worn constantly, with the result that now for several months he is entirely free from his "bilious attacks" and does not have his week-end headaches. Incidently, his convergence faculty improved immediately he began to wear his glasses.

Any complete refraction should always include a careful examination of the neuromuscular mechanism of the eyes. It is just as important as the use of a cycloplegic in determining the amount of visual error, but it is, unfortunately, the one phase of an ocular examination most neglected. The careful observer, studying the ocular muscles in any case of headache, will be fully rewarded for his efforts. At times muscular defects are quite manifest, but I refer to those cases without manifest strabismus, those patients with just enough disturbance to produce fatigue, in their efforts to maintain binocular single vision.

There may be a latent horizontal imbalance, the eyes having a tendency either to turn in, so-called esophoria, or out, exophoria; there may be a latent vertical imbalance, so-called hyperphoria or there may be a lowered ability to properly converge the eyes, a very necessary requisite in maintaining binocular single vision in near work. The eyes in these

conditions are not apparently out of line, there is no manifest strabismus and the patient does not see double except perhaps momentarily, but his ability to maintain single vision is dependent upon the amount of reserve energy he has in order to whip up those nerve centers that control the ocular movements. When his reserve energy is gone fatigue sets in and is manifested by headache.

As I have stated before, these latent ocular muscle imbalances are not infrequently passed over in the casual examination and are only revealed either by paralyzing the accomodation or by the use of prolonged monocular occlusion. This is a most valuable procedure in these suspected conditions, as it tends to break up the natural fusion forces that help keep the two eyes from deviating. Of all the muscular imbalances, the hyperphorias or vertical imbalances probably produce the greatest number of symptoms, particularly headache and nausea. The human has no ability to lower one eye while he raises the opposite one, for the associated vertical movements of the eyes, as you know, are confined exclusively to upward and downward rotations. Many of the so-called sick headaches and migraine-like attacks are due to this type of ocular muscle imbalance.

These deviations may be corrected in various ways. Sometimes the correction of the refractive error corrects the muscle imbalance. Again, one may use prisms if the deviation is of low degree, or prism exercises may be useful. As a last resort, surgical intervention may become necessary. As an example of this type of eyestrain causing headache, I wish to cite this one case.

A woman, age 44, gave a history of "sick headaches," occurring all of her adult life at least once every two weeks and incapacitating her for two days. She had had many complete gastrointestinal studies, also numerous ocular examinations. She was wearing glasses which gave her normal vision in each eye, and without her glasses the vision of the right eye was normal, and the left slightly subnormal. A careful examination of her refraction revealed practically no change from the glasses which she was wearing (a low grade hyperopic astigmatism, axes oblique), but in testing the neuromuscular mechanism there was a suspicion of a vertical imbalance. Monocular occlusion was done for six hours and then it became evident that there was a vertical imbalance of five degrees. This was corrected by incorporating prisms in her lenses, with the result that the patient's sick headaches have entirely disappeared. She has not had an attack now for a period of ten weeks.

One of the reasons for the skepticism of medical men in considering eyestrain as a cause of headache is the inaccuracy of certain refractions, and this usually is due to the lack of the use of a cycloplegic in the refraction. Many ophthalomologists are today throwing away the results of this definite knowledge regarding the use of a cycloplegic in their desire to gratify the haste of patients who naturally wish to avoid the inconvenience caused by the interference with their reading vision. Fitting glasses is not refraction. Any complete refraction includes a thorough examination of the eyes, the determination of any refractive error, the presence or absence of any muscular imbalance, the examination of the fields of vision, especially that delicate mechanism of central vision and the normal blind spots and lastly a thorough examination of the ocular fundi.

To summarize some of the important points, in every case of repeated headache the eyes should have a careful study. The presence of good vision is no ground whatever for thinking a given case of headache is not ocular. The severity of the headache does not depend upon the magnitude of the refractive error. The use of a cycloplegic is necessary, in my opinion, for a complete and thorough refraction, and a thorough study of the ocular movements should be a part of every refraction.

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Metropolitan Press, Seattle