

## **Refraction / by J.G. Parsons.**

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REFRACTION\*

BY J. G. PARSONS, M. D.

BROOKINGS, S. D.

All modern medical practitioners are aware of the fact that refractive errors have an influence on the general health. They have had frequent opportunities to observe the results which follow the wearing of an accurate correction. They note a relief from persistent headaches, migraine, and other nervous disturbances and gastric disorders commonly spoken of as "bilious attacks." Witness the statement of Musser of Philadelphia: "Who has not seen correction of errors of refraction relieve so-called 'bilious attacks,' periodical vomiting, anorexia, indigestion, and other gastric symptoms? The cure of grave organic ocular defects relieves similar gastric conditions."

It is apparent, however, to those of us who do eye and ear work exclusively that very few men in the practice of medicine realize the extent to which errors of refraction enter into the causation of extra-ocular disease. Few have looked into the subject far enough to become sufficiently familiar with it to appreciate its importance. One reason for this is the failure on the part of the medical schools, in the past at least, to emphasize this matter sufficiently, and the failure on the part of ophthalmologists to bring it forcibly to the notice of the practitioners in other fields.

The duty of the ophthalmologists, in this re-

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spect, has been very forcibly pronounced by Gould of Philadelphia, in his writings, which have been collected into five volumes of "Biographic Clinics." In these volumes Gould has studied the biographies of a number of the world's famous men and women in the effort to discover the underlying cause of their ill health. De Quincy, Carlyle, Darwin, Browning, George Eliot, Wagner, Spencer, Parkman, Whittier, Nietzsche—all furnish sufficient biographical data to enable Gould to discover that they suffered from uncorrected eye-strain. These volumes are well worth the perusal of any practitioner, and should be read by every ophthalmologist. Gould has been accused of hobby-riding and crankism by a number of prominent oculists, but he has defended his case so ably that it seems to me the profession of the United States, and the world, for that matter, must consider seriously what he has had to say.

It is from the inspiration derived from reading Gould's "Biographic Clinics" that I am impelled to write this paper, in order to pass on some of the benefits which I have derived therefrom.

In considering the physiology of vision it may be well to conceive of the eye as a prolongation of the optic tracts of the brain, associated with specially developed cells which are sensitive to light. This arrangement gives us the retina.

Intimately associated with the light perception apparatus are those nervous structures which control the internal and external muscular structures, by which the focus of the lens, the aperture of the pupil, and the position of the eyeball are regulated.

The intricate adjustment of the nervomuscular structures of the organ of vision required to produce the ordinary binocular vision is passingly wonderful. A bit of reflection will show us how dependent are man and all other

forms of animal life on the function of vision. Our very existence, civilization, and hope of the future are bound up in this most delicate little apparatus.

The functioning of such a delicate organ must of necessity require the expenditure of a great amount of nervous energy, and it is not to be marvelled at that a disturbance of this finely adjusted nervous apparatus would make itself felt in a disturbance of the nervous equilibrium of the rest of the organism. That such is the case is well known. Serious ocular disease, such as glaucoma or iritis, produces a profound depression of the whole body. In like manner, slighter disturbances long continued will produce profound reflex results. Enthusiasts have claimed the ocular origin of nearly everything, from headache to diabetes mellitus. Careful observers have demonstrated, beyond a doubt, cases of migraine, neuralgia, epilepsy, chorea, neurasthenia, gastric and gastro-intestinal disease, and spinal curvature, in which the principal source of trouble was refractive error and which yielded to the correction of that error. If this be true, then it certainly behooves the general practitioner of medicine to take errors of refraction seriously into consideration in his daily work.

It may be safely stated that a perfectly normal eye does not exist. In a flexible structure like the cornea absolutely perfect sphericity, such as would be required for an absolutely normal optic organ, is actually impossible. One of the eminent fathers of ophthalmology protested that if his optician should send him an optical apparatus as poorly constructed optically as the human eye he would send the work back. However, for practical purposes, very slight variations from perfection may be ignored, but it is shown that slight errors of refraction, particularly in departures from sphericity of the cornea, are productive of much

trouble. The eye is focused for a distance of twenty feet or more. To bring it to a focus for a point less than twenty feet requires the exercise of the function of accommodation. This is accomplished by increasing the strength of the lens, which is done by the contraction of the ciliary muscle. The power of accommodation varies according to age. At ten years, the near-point is about three inches; at thirty-five, about seven inches; at forty-five, about eleven inches, or ordinary reading distance. The power of accommodation gradually declines, until at about the age of seventy-five it disappears. For this reason convex lenses are required at about forty-five to do the work of the lens in accommodation.

An eye shorter than normal requires greater exercise of the ciliary muscle to give a focus. Such an eye is hyperopic and requires convex lenses. The opposite condition is found in myopia, where the eye is longer than normal, and requires concave lenses. In astigmatism there is an unequal curvature of the cornea. This requires the placing of a cylindrical lens at a certain definite axis so as to neutralize the inequality.

On these optical principles depend the science of refraction of the eye. The ciliary muscle must also be reckoned with. This muscle, having the power to change the focus of the eye, must be at rest, in order to obtain an accurate estimate of the refractive condition of the eye. Hence it is necessary, in nearly all cases, to obtain temporary paralysis of the ciliary muscle by a mydriatic, such as atropine, homatropine, or scopolamine. A diagnosis made without mydriasis is not reliable.

In hyperopia and astigmatism, because of defective focus, continual strain is put upon the nervomuscular apparatus of the eye, exaggerated, of course, when the extra work of accommodation is required. This continual disturb-

ance of nervous equilibrium and expenditure of nervous energy brings about the various reflex disturbances, some of which have been referred to. This is capable of clinical demonstration, as is shown by the records of any oculist. It may be investigated experimentally. Snell made a graphic demonstration by placing cylindrical lenses in front of a properly focused camera. With an artificially produced astigmatism of one-half or three-fourths diopter, the camera produces reproductions of a printed paragraph which are so blurred that it makes one almost dizzy to look at them on the printed page. If any one doubts what this would do if placed in front of a practically normal eye, let him try it, and imagine what must be the effect on one of having the eye constantly in such an abnormal state. Gould claims that 90 per cent of headaches are due to eye-strain, and the observations of most careful refractionists would seem to indicate that the percentage is not much too high. Our case-records are full of evidence to show that most frequent headaches are of ocular origin.

Gould has shown that the principal cause of migraine is ocular, and may be relieved by the correction of astigmatism. In a recent issue of the *Journal of the A. M. A.*, Reik indorses Gould's statements as to eye-strain as an etiologic factor in epilepsy, and cites several cases in point. As previously quoted, Musser recognizes eye-strain as a factor in the cause of stomach trouble, and suggests the tendency of continued functional disorder to develop into organic disease. Gould has also shown how scoliosis may be caused in school children by astigmatism at such an axis that tilting of the head is necessary in order to obtain clear vision.

With such evidence before us, substantiated by such men as Gould, Reik, Oliver, Standish, Snell, and many other eminent ophthalmol-

ogists, as well as many eminent internists, such as Musser, it is imperative that we give this matter of refraction serious consideration.

To begin with: fitting glasses is not a simple thing. If, as shown, errors of refraction can cause, and do cause, serious ocular and extra-ocular disease, and if similar conditions can be produced by lenses placed before the eye, it is a matter of the greatest importance that work of this kind be done only by those competent to do it. A lens may mean weal or woe to the one who wears it. It ought to require no argument to demonstrate the absolute futility for any person not an educated physician to attempt such work. The optician, the eye-sight specialist, the optometrist—whatever he may be pleased to call himself—is impossible to scientific medicine. As well let the counter-prescribing druggist fill our patients with *Peruna* and *Swamp Root* as to let the jeweler or any other incompetent person put glasses on them.

This work must be done by physicians. It requires special study and training. It takes time and lots of patience to do it properly. It does not pay as well as operative work, and Gould contends that it has been neglected by some of the masters in ophthalmic surgery on this account. A few general practitioners have equipped themselves for doing this work, but most of them have not the time to devote to it, even if they have equipped themselves to do it. However, every practitioner of medicine should be sufficiently familiar with errors of refraction to recognize, or, at least, suspect, them in his daily work.

No examination is complete without vision-tests. There should be a test-type card in every physician's office. Seat the patient fifteen or twenty feet from the card. With one eye covered, have the patient read the letters

on the card. If vision is normal the line marked twenty should be read at twenty feet; the one marked fifteen at fifteen feet, and so on. By using the distance in feet for the numerator we can, by expressing the number of the line read as the denominator, obtain a fraction which will indicate the acuity of vision; for example, line 40 read at 20 feet indicates 20-40 vision.

A vision of 20-20 does not necessarily indicate absence of refractive error. The ciliary muscle may be contracting sufficiently to overcome the faulty vision. In cases where other symptoms, such as headaches after reading or other close work, migraine, or congestion of the lids, seem to point to an error of refraction a mydriatic should be used. For this purpose 1 per cent atropine or 1-500 scopolamine may be instilled two or three times, and the patient examined the next day. This will put the ciliary muscle at rest, so that the amount of vision may be determined accurately. Scopolamine is preferable to atropine, as it works more quickly. After two instillations fifteen minutes apart the eye may be examined in an hour. If vision is below normal the patient should be refracted by some competent physician.

At this point many physicians fail to recognize the importance of their duty toward their patients to see that they fall into the hands of competent men. Frequently the physician suspects refractive error and tells the patient he needs glasses, after which the patient is very liable to consult the nearest spectacle-vendor and buy of him. It is just as reasonable to inform a patient that he needs medicine and allow him to go to the nearest drug-store and take whatever the druggist wants to sell him. Again, let me emphasize the importance of seeing that this work is done by a competent physician. Such a man will not care to be

placed in the same class as a spectacle-vendor, and the referring a case to him "for glasses" tends to make the patient consider him as such. If the physician wishes to refer such a case, let him write a note to the specialist, and inform the patient he is to consult such a person about his eyes. In this way a great deal of trouble may be avoided. The patient does not fall into incompetent hands, and the specialist is not looked upon as a tradesman.

It is well to note the importance of systematic examination of the eyes of school-children. If this is done annually by the teachers many cases of visual troubles will be discovered long before they would be recognized otherwise, and the children will be saved the consequences of uncorrected refractive errors. It is also important that this work should be under the control of physicians, and the parents taught the need of consulting the physician and avoiding the optical quack. I believe it is a solemn duty of the profession, and of the oculists in particular, to enlighten the public on this matter. There should be some way devised whereby this can be done without opening the way for quackery.

To illustrate some of the points mentioned in the foregoing I have selected a few cases from my records.

CASE 1—Mrs. D.; aged 40; housewife; has attacks of sick headaches about every two weeks; is very nervous; sleeps poorly; has had all kinds of medical treatment, with practically no benefit. The last physician she consulted suspected eye-strain and referred her to me. Vision in each eye 20-30. Under scopolamine vision in each eye 20-50. With plus 75 cyl., ax. 105, left eye; plus 50 cyl., ax. 115, right eye; 20-20 each eye.

She has worn this correction with comfort for three years and has not had a recurrence of her sick-headache, except once or twice,

when she got her frames bent, thus changing the axis of the cylinders.

CASE 2—Miss P.; aged 43; had sick-headaches for twenty-five years, coming at irregular intervals, but always associated with reading or sewing. Always troubled with indigestion; for ten years suffered from neurasthenia of a pronounced type; very melancholic; at times talked of suicide; felt sure there was trouble with her eyes; had worn at one time minus .50 spheres, fitted by an optician; from these she received no benefit. Two years ago she consulted me, and received the following correction: Right eye, plus .50 cyl., ax. 165; left eye, plus .75 cyl., ax. 30.

She has since worn these glasses and has been free from headaches. Her general health has improved, so she hardly knows herself; is able to attend to her work and enjoys life; digestion is good, and she can eat anything. Think of twenty-five of the best years of a life blighted because of the failure to recognize and have corrected a small error of refraction!

CASE 3—Miss M.; aged 25; stenographer; subject to severe headaches; health otherwise good; had worn plus .50 spheres, each eye; was refracted later by a physician who gave her plus 1.00 spheres, each eye, with some improvement, but the headaches still persisted. Vision 20-20, each eye. Under scopolamine, vision 20-200 each eye. Accepted plus 4.50 sphere, each eye. Prescribed plus 3.50 sphere, each eye, which she has worn for two years with perfect comfort and with relief of headaches.

This case will illustrate the unreliability of examination without a mydriatic, there being three-and-a-half diopters of hyperopia, which were unrecognizable without the mydriatic.

CASE 4—Mrs. P.; had severe siege of neurasthenia, during which she made slow progress under ordinary methods of treatment, includ-

ing rest cure, intensely severe headaches at frequent intervals, and all the other symptoms of an aggravated case of neurasthenia. After refraction under atropine she wore the following: Left eye, plus .50 cyl., ax. 105; right eye, plus .50 cyl., ax. 75.

After receiving this correction her condition improved rapidly. She is not entirely well, but is greatly improved in health, and she finds that if she leaves off her lenses she becomes dizzy and speedily develops a headache.

CASE 5—Millie K.; aged 8; general health, good; does not like to go to school; has styes frequently; has a choreiform movement of the eyelids, which worries her mother. She received the following correction: Right eye, plus .50 sph. ( ), plus .50 cyl., ax. 90; left eye, plus .50 sph. ( ), plus .75 cyl., ax. 90.

With these lenses the child recovered from the choreiform movements, became interested in her studies, and had a new attitude toward school.

CASE 6—Miss C.; aged 20; suffered severely from headaches and congested eyes while in school; consulted an "optician of twenty-five years' experience," who gave her some weak concave lenses. Vision in each eye under mydriatic 20-50, 20-20 with plus 1.25 cyl., ax. 90, each eye. Examination of fundus shows large atrophic patch, the result of choroiditis,—a fine comment on the skill of the "optician of twenty-five years' experience!" Does it not also speak in no uncertain tones to the medical profession of their duty to their patients and to the public in general as regards this matter of refraction?

These experiences are common to all oculists. We see cases of nephritis with pronounced albuminuric retinitis, which have come to us after having tried to get relief from a pair of spectacles fitted by an optician, or an eye-sight specialist, or an optometrist!

One of the penalties of progress in civilization is defective vision. As long as medical men have patients to treat there will be an increasing number of cases with errors of refraction, manifesting themselves in various forms of extra-ocular disease. Is it not, then, our solemn duty to take this fact into consideration in our treatment, to see to it that they receive proper attention from competent men, and to make it our business to let the public know the truth in order to protect them from the impositions of the incompetent?

