A Lecture

ON THE

VALUE AND MISUSE OF SPECTACLES IN THE TREATMENT OF HEADACHE, MIGRAINE, AND OTHER FUNCTIONAL TROUBLES OF THE EYES.*

BY

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WHILE I approach the subject of my lecture with the keenest interest, I am not free from a certain amount of trepidation, for I know that I must necessarily tread on the toes of some to whom it has become almost a gospel to inflict on mankind on the smallest pretext the machinery of spectacles. It is in no sense an exaggeration to say that we are at the present time face to face with honourable, high-minded medical practitioners who honestly believe that they are preventing the incidence of tubercle, appendicitis, and other troubles by correcting minute refractive errors such as probably more than 90 per cent. of the population would be found, if examined, to possess. It appears to me that the word "astigmatism" has produced in them a mental condition resembling the condition that represents. In addition to these doctors, the country is flooded with opticians, many of them capable men and highly trained in physical optics, who, with no knowledge whatsoever of disease, are strenuously pointing out to all and sundry that the human eye is not a very perfect form of optical instrument, and that glasses can correct some of its errors and therefore should be worn, with the result that great numbers are quite unnecessarily disfigured by wearing glasses, and, what is probably worse, are placed under certain disabilities that accompany the wearing of spectacles.

A little more than thirty years ago I remember reading a book on headaches in which refractive errors of the eyes were not even mentioned as a cause, but nowadays the physical factor of refractive error has so possessed the medical mind that that one condition alone is deemed sufficient to account for functional symptoms without much attempt being made to further differentiate the actual *causa causans* that arises from such errors; but this will not deter me from speaking boldly, and making a protest that is much needed at the present time, against the promiscuous prescribing of spectacles. But at the same time that I make this protest against what I believe to be the misuse of glasses, I wish as loudly to proclaim the enormous benefits and relief from suffering that has attended the development of our knowledge in connexion with their use.

I will now proceed to deal with the manner in which these refractive errors provoke functional troubles, chiefly associated with the sensory branches of the fifth nerve; and I hope to bring before you certain facts which, if they have been before noted, at any rate have not been included in the textbooks on the subject. The principal troubles that refractive and muscle balance errors produce may be divided, roughly and somewhat artificially, into those that are caused by peripheral conditions and those by central conditions, the former often bringing about and merging themselves with the latter. The former include: Pain at the back of the eyes, pain at the brow, tender and bruised feeling of the eye, heaviness of the lids, pain at the inner canthi, pain at the nape of the neck, and morning discomfort. The latter include headache, sickness, sleepiness, polyuria, migraine. Of the former, the first four are due to fatigue of the ciliary muscle and are chiefly associated with hypermetropic errors, but may occur with anatomically normal eyes, and in any case you may be sure that the ciliary muscle is involved when the patient complains of pain at the back of the eyes. That it is a very definite localization of pain may be gathered from the fact that it is an expression used by high, low,

rich and poor, and is no mere phrase that might have been adopted as expressive of ocular discomfort. The bruised and tender feeling of the eyeballs is manifest on pressing with the fingers on the eyes through the upper lid, and those of you who have felt it know very well what it means. The heaviness of the lids which helps to produce the sleepiness of the second category is due to the failure of the levator palpebrae. It is constantly in action, like the ciliary muscle, and receives innervation from the same nerve. The pain occasionally felt in the corners of the eyes is due to fatigue of the convergent muscles, and when it occurs is more often associated with exophoria. Pain at the nape of the neck is very often, perhaps always, associated with disturbance of muscle balance such as occurs in heterophoria, a term which includes exophoria, esophoria, hyperphoria, and hypophoria, signifying that the eyes in a state of rest are either divergent, convergent, or one looking up and the other down, the terms "hyperphoria" or "hypophoria" being interchangeable according to which eye you regard as being in the normal position.

I have said that pain at the nape of the neck is "perhaps always" due to disturbance of muscle balance, because when there is no hyperphoria there may be a strain on the external muscles of the eye by the innervation that they receive approaching the limit that is possible in what is known as the amplitude of relative convergence. It may be as well that I should explain what is meant by this expression. When the eyes are focussed for a certain point they have, in order to avoid double vision, to be directed accurately to that point—in other words, the eyes converge upon it. Now the power of convergence and accommodation are so linked together that with a certain amount of accommodation it is only possible to produce convergence within a certain range—that is to say, a certain degree more or a certain degree less than is required to accurately fix the object looked at; and this is a reciprocal condition, for when the eyes converge upon a certain point it is only possible to stimulate the ciliary muscle a certain degree more or a certain degree less than is required to accurately focus the object, and this range is the amplitude of relative accommodation in contradistinction to the former condition, which, as I have said, represents the amplitude of relative convergence. I may further illustrate this by pointing out that, being normal-sighted, you can only accurately focus a distant object with one eye through a high concave lens, which requires a great deal of accommodative effort to neutralize its power by allowing the eyes to converge—that is, to squint. This proves that, in using your accommodation to the extent that is required to neutralize the concave lens, you have exceeded the maximum of the range of relative convergence for the point looked at; and in order to use the amount of accommodation needed you have to converge the eye to a much greater degree than is required for the fixation of the object with both eyes, and the excessive convergence used is manifest in the eye that is not fixing. This may seem rather involved, but if you closely follow out what I have said you will be able to understand what I mean.

Now, returning to pain at the back of the neck being perhaps always due to muscle balance strain, you will, I hope, be able to realize my point. If a patient has no heterophoria, but has a high degree of hypermetropia, the correction of the error may make so high a demand upon the accommodation as to stimulate a demand for relative convergence; this would necessarily make a great demand on the endurance of the external recti in restraining convergence, and in this way produce the kind of trouble that is induced by heterophoria. Morning discomfort about the eyes is more commonly felt by people in middle age who use their eyes a good deal overnight. It comes on frequently even after a good night's rest, and patients consequently feel surprised that it should be connected with use of the eyes the previous day. It is a symptom generally of accommodative strain, and though, as I have said, it is most common in middle age, it may be experienced by the young.

To pass on to my second category—conditions which I have attributed to disturbances of the higher brain centres, and especially to the fusion centre. I take ocular headaches as the principal example of this class. Now, the main points of ocular headaches are as follows: They

* Delivered to the candidates for the Diploma in Ophthalmology.

occur in childhood, and frequently as sick headaches; and, though sick headaches may persist in adult life, the type most commonly met with then are nervous headaches. I have noticed great attempts to differentiate the one from the other, but, after all, the only difference is that with the one there is sickness, or a sense of nausea, and with the other there is not. These headaches generally tend to pass off about the age of 50, and when a certain treatment is being employed about that age it often gets the credit, which it does not deserve, of curing the headaches. But there is another form of headache that comes on at about this age, but this is mainly due to failure of accommodation and insufficient help from spectacles. There is another cause which concerns the fusion centre and that is monocular diplopia produced in a remarkable way by astigmatism. This becomes more marked in middle age than in early adult life, and is seldom recognized in children; the condition is probably corrected by a subconscious irregular action of the ciliary muscle, and as its power gets less in middle age the subconscious correction is less effectual. Anyhow it often produces severe headaches from the uncertainty in fusion of the images of the two eyes. These conditions, too, give rise to the morning discomfort of which I have spoken.

Ocular headaches are generally frontal, and are often associated with browache and tender eyeballs. They come on after using the eyes at detail, reading and things of that sort, but what perhaps provokes them more than anything else is detail at a distance, watching a cricket match in the sun, theatres, picture galleries. Near detail is more often associated with the peripheral pain of the first category. The headaches may culminate in sickness, which generally gives relief, but sometimes exaggerates them. They rarely pass off without sleep unless some drug like phenacetin has been taken, which, with the majority, relieves, though a definite minority get no help whatsoever. It is very rare for ocular headache to persist after sleep, and the fact that it does so throws grave doubts upon the question whether the eyes are the cause of headache in that particular instance. Patients who suffer from this form of headache are generally of the neurotic type, and often unduly thin. They frequently dread excessive light, and pull down the blinds when snow is on the ground. They also avoid looking out of the window in a train, and such other things as tend to give rise to headache, though they may not have associated these particular actions as due to preventing headaches, but merely as avoidance of disagreeable conditions. Another symptom that is nearly always constant is polyuria. Perhaps this comes on more as the headache passes off. It has always surprised me very much that this symptom has never been noted, though it is often very marked indeed.

I mentioned just now that I considered these conditions of the second category as mainly due to disturbance of the fusion centre. My attention was first drawn to this form by noticing how very rarely one-eyed people and people who squint, or who have not therefore binocular vision, suffered from functional trouble dependent on the use of the eyes. A moment's consideration will show that this is not surprising, the effort entailed by binocular vision being enormously greater than by monocular vision. In the case of the former, the relative conditions of the muscle controlling the movements of the eye are constantly altering; every movement of the body has to be compensated and every alteration of the line of vision requires relative adjustment, the requirements in each case involving more or less all the external muscles of the eyes in an extraordinary involved evolution, whereas the one-eyed person escapes all such minute details. It is true that the one-eyed does not entirely escape, for the demand upon its functional activity is constant, whereas in two-eyed vision one eye is constantly relieving the other, as may be noticed by a simple manoeuvre, such as staring without blinking at a knife on a white tablecloth—or, rather, not at the knife, but, as it were, through it, at an imaginary point some distance off through the table, so that, the eye not being converged on the knife but at a more distant point, the knife looks double; after a few moments the blade, may be, of one of the two images disappears, slowly to reappear, while the handle of the

other disappears, and so on. You will notice that the action of blinking immediately dispels the illusion.

I think that all surgeons of experience will agree with me that the one-eyed do largely escape functional symptoms, but if this be not sufficient to demonstrate that the difficulties of the fusion centre are the principal cause of the functional troubles of which I am speaking, the point can still further be supported by noting the conditions of refraction that most commonly are associated with them; and here I think I am at variance with most observers, for, whereas astigmatism is generally spoken of as being the most frequent cause, I find that far and away the error most frequently associated with ocular headaches, etc., is anisometropia—a condition that involves two different retinal images, and lays a severe task upon the fusion centre, and I strongly suspect the main factor, when astigmatism is the cause, is the dissimilarity of the retinal pictures and the consequent difficulty of fusion. Another point in favour of my argument is that monocular diplopia produced in a peculiar way by astigmatism is very frequently associated with headache. Of course, the fusion centre is not always alone responsible, for it has an active *particeps criminis* in the focussing centre, on which in many cases, especially in hypermetropia, it is making constant demands for definite images, and for their constant maintenance as definite images. In connexion with this I have often noticed an interesting fact, which I have not seen mentioned anywhere—namely, that the eyes have an automatic power of fine adjustment over and above that which can be stimulated by the will, and that each eye has this independently of the other; I state this is a fact which I maintain I can abundantly prove, though this is hardly the occasion to do so. It comes to this, expressed in a popular way, that the fusion centre makes a demand upon the accommodation centres of each eye that they shall produce for the fusion centre for its purposes as perfect an image as possible, and each centre has independently of the other within a certain rather small limit the power of stimulating the ciliary muscle of its own side, and, according to some observations I have made, even a little irregular action in compensating a certain small amount of astigmatism. Now, in addition to the powers the fusion centre has over the independent accommodation of each eye, it has the same sort of power over the centre controlling the external muscles of the eye, and this again is independent of the will. If you place a low prism base up or down before your eyes, without any conscious effort on your part the two images will fuse; sometimes, but not always, it is true that by a strong voluntary effort you can inhibit the fusion. The same thing is exemplified in heterophoria. And you may notice that it is people with heterophoric errors who screw up one eye in bright sunshine, the explanation probably being that, dazzled and worried, they are not able to attend to all the exigencies of the occasion, which they shirk by closing one eye. It is, then, I maintain, the action and reaction of the fusion centre and the lower centres upon which it relies, the constant effort to fuse dissimilar images, the constant demand on the accommodation to produce and maintain perfect images, with the constant tendency to failure from exhaustion, that provoke the symptoms we call ocular headache, and I have tried to prove to you that they do so from causes which are mainly subconscious and independent of will power. As one would expect, these symptoms appear when from any cause the bodily vigour, which we call "tone," is lowered. This frequently gives rise to erroneous conclusions in the lay mind, and it is common observation to us all, I suppose, to note that those patients whose headaches are very obviously due to the refractive conditions of their eyes or of their muscle balance are the ones who most readily disclaim the connexion. You will all recognize my quotation, "Oh, it can't be my eyes, because they always get well when I go away for a change." Again, "It can't be my eyes, because I have had these headaches all my life, and my father used to have them too." The obvious answer never seems to occur to them, that when the general health is improved the effort that still exists is able to be made without discomfort; or, in the second case, that they have had the same eyes all their lives, and probably their fathers had the same refractive error, for the shape of the eye, on which generally the refractive error depends, is just as

much a family hereditary feature as a nose, mouth, or chin; and, of course, the fact of the hereditariness of refractive errors is constantly demonstrable.

When I separated these ocular manifestations into two divisions, the peripheral and the central, I pointed out that the former merge into the latter; and from what I have said it will be obvious that the disturbance of the brain centres that produces headache is associated with symptoms of exhaustion of the muscles that produce the peripheral symptoms, and together with headaches, as I have before mentioned, intense browache and tenderness of the eyeballs frequently coexist; but this is not always the case, and headache, usually frontal, may be present without other symptoms. I have expressed the opinion that anisometropia is *facile princeps* the cause of headache, but that hypermetropic astigmatism and simple hypermetropia are frequent agents, and I must now say a few words as to the relative rarity of functional symptoms with myopic errors; when they do occur, I believe, as with hypermetropic errors, the trouble arises with the fusion centres. If you have followed the points I have tried to bring before you, it will not be difficult to understand this relative rarity. I have pointed out that the trouble arises from a vicious circle. The fusion centre demands clear images and makes demands on the lower centres which control the muscles of the eyes; the muscles become exhausted, the images become indistinct, and the fusion centre becomes more imperious as its task becomes more difficult. Moreover, all these details are mainly subconscious and independent of the will. When our subconscious self is left to itself, it soon recognizes its limitations and makes no futile attempts, in this way differing from our voluntary self, which is constantly making futile attempts. I can illustrate this by the prism of which I spoke just now, base up or base down, and I said then it should be a weak one, and that without voluntary effort the displaced images would fuse at the same time a sense of discomfort arises. If, however, you use a strong prism, no attempt at fusion will be made, and so long as you do not try to move about, when other conditions would come in, no sense of discomfort will arise; there will just be double images. Now, with myopia no effort of the ciliary muscle can neutralize the myopia, and the subconscious self does not make the attempt, and therefore this cause of headaches, which I tried to show was effort on the part of the accommodation centre to accede to the demands of the fusion centres, does not exist. Moreover, the fusion centre itself has no detailed demands made upon it. When troubles do arise they are more often of the peripheral kind, and are generally due to heterophoria, relative convergence, and the disturbance of vision by inappropriate glasses, upon which I will touch later on.

The extension of the disturbance in ocular headache from the ocular centres to those controlling the stomach is a remarkable one and not readily explainable. It is true, however, that the association of the stomach and its needs is often closely associated with the senses of sight and smell, and there are, of course, intimate association fibres between the centres.

With regard to polyuria that occurs with these headaches, perhaps more often as the attack is passing off, I do not know whether it is produced by raising of the blood tension or direct stimulation of the kidneys. My investigations into this have not been extensive or regularly made; yet in cases which I have examined I have not found the blood pressure always definitely raised or the urine of unusually low specific gravity; indeed in some cases its specific gravity has been rather higher than normal. However, I have no great confidence in these observations. I merely put them forward, so far as they have gone, as suggestions of the need of more accurate and constant observations in this direction.

I will just mention sleepiness as being in the central category. It is a frequently noticed symptom in association with accommodative effort, and, I suppose, is a sign of lag in connexion with this centre and the motor centres in stimulating the levator palpebrae, but it is probably also to some extent an association symptom, the closure of the eyes being associated with sleep, and exhaustion of the levator palpebrae tends to produce closure of the eyes.

Now, with regard to migraine, I have seen in books and

heard opinions expressed that refractive conditions have nothing to do with it. I think it is hardly necessary to argue this point; the association of the two is so common that it is quite beyond the possibility of a coincidence; it is true that migraine attacks some people who have no refractive or muscle balance errors, but so may headaches and aching of the eyes; in other words, functional troubles may arise without any errors, in the same way that legs may ache unduly without walking, if the patient is below par or out of health, without there being any malformation or other abnormality. Notwithstanding this argument, I feel no doubt that other centres than those for sight are sometimes first implicated and the disturbance has spread to the visual centres. Migraine is in its later manifestations very much the same as ocular headache, but its incidence is peculiar and the first symptoms are usually disturbance of the centre for light perception, but there may be other prodromata, especially in those cases which, as I have mentioned before, are not primarily eye centre cases. I cannot do better, in order to describe an attack of migraine, than read to you an account of his own attacks that I got from one of my patients:

I can remember having had sick headaches all my life, and I can remember "zigzags" after a fall when I was about 9. I have attributed attacks to the following causes: Mental worry, shock to mind or body, over-exertion, sudden changes of temperature, indigestion, going to the theatre, rowing, or any work that necessitates holding my arms above my head, such as hanging pictures.* The greater number seem to me to be caused by sudden changes in the weather, but any great anxiety or worry almost invariably brings on an attack within a day or so. The majority of the attacks have of late years come on in the small hours of the morning, but I have had them at all hours of the day and night. The first symptom of an attack is a mistiness of vision. I am told, however, that just before I am conscious of an attack I am flushed for a few moments, having previous to that been very pale. I can only see one half of what I am looking at distinctly; there seems to be a general mistiness over the other half. Sometimes this is the right half and sometimes the left. After a few minutes a zigzag of light suddenly appears in the same half of the field of vision as the mistiness. This zigzag always appears in the same spot (that is, when it is in the same half of the field of vision). When it appears in the right side of the field of vision it always appears just to the right of the centre of the whole field and about one-third from the top. When it appears in the left side it is just to the left of the centre. The zigzag (except in two instances) is horizontal and flickers the whole time, the motion apparently being from left to right. The two instances when the zigzag was not horizontal were in each case when the attack followed a day or so after a previous attack. Then they were vertical, commencing almost at the top of the field of vision and ending at the spot where the horizontal zigzags start. The wave-like motion was downwards. In each case they were in the right side of the field of vision. In one case the zigzag gradually swung round to the right from the top, as if pivoted at the bottom, being gradually joined by other zigzags until the general appearance was much the same as usual. To return to the ordinary attacks: The first zigzag, after a short period, is joined by other and longer zigzags until the whole of that half of the vision is covered with zigzags and generally clouded. The zigzags are not coloured in any way. They are always accompanied by shudderings. They last any time from ten minutes to half an hour, and, roughly speaking, the severity of the attack is in proportion to the number of the zigzags and the length of time they stay. Usually between the first appearance of the mistiness and the zigzags I have slight palpitations of the heart. From half an hour to an hour after the appearance of the first zigzag a headache comes on. This is confined strictly to half the head, and is invariably on the opposite side to that in which the zigzags were. This headache is accompanied by sickness. There is usually no trace of food in the stomach, but small quantities of liquid are brought up, of a very pale greenish colour, which have a peculiar faint fishy odour. Sometimes I am sick within a few minutes of seeing the zigzags. The headache is located chiefly in the forehead just over the eyebrow. The pain gradually grows in intensity until, in a bad attack, it seems more than I can bear. It generally increases in a series of waves, the height of the pain in each one being worse than the previous one; at this point I am usually sick. After the sickness the pain gradually dies down, and then as gradually rises again until the next sickness. When the pain is very bad, I get instant temporary relief by the application of a hot sponge to the back of my neck.

At the height of a bad attack I get a curious numbness in my arms and half my hands; and with a very bad attack a sort of paralysis down the left half of my tongue, and I have a great difficulty in forming my words, in fact, cannot make myself understood, as I cannot say the words I want to. The attacks vary very much in their intensity and duration, and have, in the past, lasted as long as ten hours. During a bad attack the breathing becomes abnormal—spells of very laboured, extremely

* The cause here is probably the strained position of the eyes upwards.—R. W. D.

rapid breathing alternating with spells of very light, almost imperceptible breathing, with a long deep breath at regular intervals. When an attack is in progress I cannot stand any light, even moderately bright daylight very much increasing the headache.

The attacks were at their worst in 1891, when I lived for a year near Birmingham, where I entered an office for the first time, and in 1903, the first year of my married life. About two years ago, on the advice of my wife's doctor, to whom she had mentioned my attacks, I tried bicarbonate of soda in hot water as soon as I had the first symptoms of sickness. Since I have done so I have not had an attack of the worst kind.

Although occasionally an attack comes on without the slightest warning, I generally have warning a day or so before. Even then I have no idea when it will come on. I have three kinds of warning—intense sleepiness, a *bitter taste** in the mouth, and a feeling of great weariness, accompanied by deep sighs. The first and last are the most fatal, the bitter taste is not usually fatal unless it goes on for several days. The sleepiness is generally most marked for half an hour or so before and after a meal. The feeling of intense weariness comes on in the evening preceding an attack, when it comes on in the small hours. I have noticed many times that I have been feeling for days that an attack is imminent, and then one day I feel remarkably well and light hearted, and then an attack comes on. Again, I have repeatedly waked in the morning and thought what a beautiful night's rest I have had, and then an attack has come on either before I have started to get up or while I was dressing.

In the case of this patient there was only a very low hypermetropic error, and I do not regard his attacks as primarily due to ocular centres, although I think the later stage of headache and sickness is probably in his, as well as in other cases, due to disturbance of the fusion centre in the same way as in ocular headache, for you will notice that in migraine the headaches and sickness that occur are always secondary to visual manifestations. The most common visual manifestation is the zigzag light or fortification outline that is experienced at the periphery of the field of vision; another is the shivering cloud that, beginning as a spot, gradually spreads over the whole field; or there may be a large absence (negative scotoma) in the field of vision, or, again, hemiopic loss. The counterpart of these sensory manifestations is a peculiar form of migraine when the ocular motor area is affected, and a temporary paralysis or paresis of one of the ocular motor nerves, generally the third, follows the attack.

I have now gone briefly but widely over the range of functional disturbances associated with the eyes, and I must pass on to the main object of my lecture, and that is treatment and especially the treatment by glasses.

There are certain general principles in the way of treatment that I should first point out. If you have a thin, neurasthenic worrying patient to deal with, you will probably do more good than by any other means if you can improve his general state of health, fatten him, and succeed in getting him not to worry. The vigour of such patients will thus be increased, and they will be able to make the functional efforts required by their particular conditions without exciting the functional troubles of which I have been speaking. This, however, is easier to suggest than to carry out successfully. The Ethiopian cannot change his skin nor the leopard his spots, and you will find it wellnigh impossible to teach the patient with a Martha-like disposition not to be troubled about many things. However, if not entirely successful, much can be done in this direction. Iron or arsenic may be given to the anaemic. The digestive tract should be attended to, those with poor physique should develop themselves by muscular exercises. An actual attack may be cut short sometimes by a violent mental effort or tremendous physical exercise, and often successfully by such drugs as phenacetin, antipyrin, aspirin, or the like. But to really treat the condition you must deal with the cause. The time when these functional symptoms usually declare themselves are in children, when they begin to grow out of their baby fat and do lessons more seriously; again, a little later on when children are growing rapidly, in girls, especially about the age of 17, in boys when they have gained nearly their full height, but have not filled out, in women after childbirth, especially during lactation, and in both sexes after exhausting illness. If the symptoms you are called upon to deal with are merely those of eye strain, pain at the back of the eyes, in the brow, or at the nape of the neck, and you find that there is

small hypermetropic error less than, say, 2 D., or a small muscle balance error, it is certainly not necessary at once to assume that glasses must be worn always or even for near work. True, it is usually advisable to help the accommodation temporarily, but this is by no means always the case. You should take a broad view of the situation: if the patient be a child, if you see that the lowered tone is obviously due to a temporary cause and the error be a small one, you can do all that is required by moderating the task that the eyes have to bear daily, and by regular and gradual increasing use train the ciliary muscle to do the work that is required of it, even though it be a little more that is required of a normal eye. It is more generally advisable to give glasses temporarily to help the patient over the stile, but you must recognize that you have not done everything that is needed for your patient if you are content with putting machinery on his nose. Glasses, in themselves, are a disability; they spot with rain, they get dewed, they often break, they pinch or mark the nose, they are always unsightly, and in many other ways a nuisance. You may say that patients get used to them, but so people can to many undesirable things, as living in a sewer or not washing—I give extreme instances—and I maintain that in hundreds of cases in which they are worn they are at least unnecessary. To say that they are necessary is to deny that the ciliary muscle can do its work, and I am prepared to argue with any one that, in numerous cases in which glasses are worn, the muscle has the potentiality to do its work if only it were allowed the chance of developing itself and demonstrating its power. Patients may be given glasses to help them in time of especial need, and the fact that when they get stronger, and the glasses are taken away, the eyes ache, is given as proof that they are still needed. But of course the eyes ache; a muscle will not develop itself beyond its need, and when glasses are taken away it must have a few weeks to develop itself to bear the burden of which glasses have relieved it, but which the improved health of the patient may permit. Fortunately, patients as often as not take the matter into their own hands and discard the glasses which they have been told they must always use. I am now only speaking of patients who have been given glasses for near work, but very often the patients, with perfectly acute vision, have been placed behind glasses to be worn always. In the cases of which I am now speaking, this is not only undesirable but absolutely wrong, for to allow the child's ciliary muscle to do the slight extra work for distance that is involved in low degrees of hypermetropia tends to develop its function and more capable of making the increased effort at near work, which may also be further relieved by glasses. The advantages of the physiological functional exercise in treatment of not only children, of whom chiefly I have been speaking, but also of adults who are suffering from strain of accommodation, seem in danger of being entirely lost sight of. Supposing a person has to walk daily so many miles to his work, and his legs ache, you would not put him to bed for a month to develop the power of the muscles of his legs; you would make him develop his muscles by walking. Why, then, treat the ciliary muscle differently? When a patient complains of aching of the eyes, and, may be, dazzling by light, the usual treatment he receives, even at the hands of many who ought to know better, is rest of the eyes, and perhaps dark glasses, and so he may go on for years. I have known many such cases who are nothing less than artificially manufactured invalids. It cannot be too loudly or forcibly proclaimed that in functional troubles and in functional failure, the treatment that should be adopted is not rest but exercise. To remember and act on that simple fact would be of invaluable benefit to mankind. I saw on this day that I am writing a patient, a man well up in the Indian Civil Service, who, eleven years ago, was told by one of our leading ophthalmic surgeons that he must give up his work at Oxford at which he was then engaged, give up all ideas of the Indian Civil Service, and go on a farm. He was sent to me by a tutor of his college, but so impressed was he by the verdict that had been given him, that I had to beseech him and get the influence of his tutor to induce him to wait three months and try if he could not, by exercise, develop his ciliary muscle to do its work. The fact of his position now shows that within three months he had recognized

* This bitter taste is not a sour eructation, but is from nerve excitation. I inquired carefully into it.—R. W. D.

his power. I really cannot understand how it is that many excellent, scientific, experienced ophthalmic surgeons will not recognize that the ciliary muscle, like any other muscle, can be "Sandowed," if you will allow me to use this expression to impress what I mean on your minds. In developing the ciliary muscle by functional exercise there are a few points you must remember. You must begin with a small amount and gradually increase, and the exercise must be regular, the same amount each day, not more one day when the patient feels "fit" and less when he feels down. It should be the same sort of training for which the athlete goes in. And especially when you have gained the patient's confidence and he feels he is gaining, you must not let him go too fast, and when his eyes are developed up to the required amount of work—say, five or six hours a day—he should keep on regularly with this for some weeks before he attempts to use his eyes freely, sometimes more and sometimes less.

I have hitherto been speaking of low degrees of hypermetropia with functional trouble, but there are high degrees which you will recognize at once are beyond the power of the ciliary muscle, and in these cases you will have to consider the physique of the patient and his conditions of life in prescribing the glasses constantly or only for near work; the necessities of each case, combined with common sense, will lead you to the correct treatment.

Muscle balance errors must sometimes be corrected, but it is well to hold off doing so if you can. It so often leads to the demand for constant glasses, especially in cases of hyperphoria, but you may often correct with advantage half the amount that may exist of exophoria (weakness of external recti, as it used to be called). The much more uncommon condition of esophoria illustrates, sometimes more than other forms of heterophoria, the advantage of a prism. Eyes with normal refraction suffer in this condition, and the cause is more frequently, I think, than in any other error, overlooked. If you recall what I said about relative convergence, you will realize the great difficulty the ciliary muscle has in focussing to the required degree when the eyes, already converged in a state of rest, require little or no voluntary effort of convergence. Accordingly, if you bring about this requirement by giving the patient a prism base out even to the full degree of the error, though less may be sufficient, you will enable the ciliary muscle more readily to do its work in relative accommodation. Cases of hyperphoria that require glasses are among those who should wear them constantly.

Now, as regards headache and migraine, I hold that you cannot with any confidence undertake to give your patient any relief, except sometimes in cases of simple hypermetropia when the centre for accommodation only is involved, unless the glasses are worn constantly. The commonest error that provokes the symptoms is anisometropia, and in that condition, while one eye has bad vision, the other often has supernormal vision. In these latter cases you are met by a great difficulty. The patient has supernormal vision, and you ask him to imprison himself always behind glasses, with all their attendant disadvantages, in order to relieve him of a possible headache, say this day six weeks, and yet only by wearing the glasses can you give him any hope of relief. The question here becomes one for practical consideration. To put it popularly, Is the game worth the candle? In these cases, where you have no other practical advantage to offer the patient, he has to consider whether he will put up with an occasional incapacitating headache or wear glasses always, and the judgement may fairly be left with him. But in cases where the vision of both eyes is bad, more frequently the case with astigmatism, then there is infinitely less difficulty in advising glasses, and, of course, in all those cases where patients' lives are being spoilt by constant headaches and incapacity, there is no question whatever. Instances in which patients' lives have often been altered by means of constantly-worn glasses from continual suffering to practically complete health are by no means uncommon.

The headaches of middle age can generally be relieved by giving proper presbyopic glasses, save those that are due to monocular diplopia, and for such glasses must be prescribed for constant wear.

Finally, I have to deal with the kind of correction that should be worn, and at the outset I will say that I agree

with those who give the most exact correction for every error in the case of patients who have to wear glasses always; but I go no further in this direction, and I am fully aware that the views I am going to put before you will receive the most determined opposition, nevertheless I unhesitatingly assert my firm conviction of their correctness. I hold that unless you are going to give glasses for constant wear, you should not correct in detail the error of each eye, but should give a common amount of help to each; in other words, you should not upset in any way the relative condition of one eye towards the other. For instance, if the refraction of the eyes be unequal, and you correct the errors for reading, when mealtime comes the patient leaves off his glasses, and is looking at his plate about the same distance as reading with the eyes unequal, or he may be talking to a friend and looking at his watch. I maintain that for real comfort the eye should always be used under the same relative conditions; that you should not correct astigmatism or anisometropia unless you are prescribing constant glasses, and especially is this the case when you supply a patient with presbyopic glasses; indeed, if you do, you will find that very often he will desert you, and go to another ophthalmic surgeon and say that he cannot wear your glasses. The only disadvantage of this doctrine is that it encourages men to do slipshod work, but it is no excuse whatever for not working out the errors that you are not going to correct them.

The question of myopia does not strictly come into this lecture, but I just mention incidentally that myopic children during the period of growth and development should wear fully-correcting glasses always. It is then that the short sight develops, and nothing checks its development like glasses of the kind I have mentioned.

One word as to cosmetic considerations in glasses. One so often sees pretty, golden-haired children in gold spectacles, the parents saying, "Poor dear child, if she has to wear glasses, let them be gold ones," quite losing sight of the fact that the gold, by simultaneous contrast, takes all the shine and brightness out of the hair. When glasses for adults have to be worn always, it is probably desirable that they should be made as inconspicuous as possible, but glasses to harmonize with the face are always more or less of a failure, and when less inconspicuous are only less of a failure. I myself always think, when glasses are worn only for near work, that no attempt should be made to make them harmonize with the face, and that great large round tortoiseshell frames are the best and most comfortable. True they are grotesque, and people will say, "What dreadful glasses you have got on! where did you get them?" but they will not say they spoil the face; on the contrary, if the face be a beautiful one, the contrast will rather add to it than detract from it. However, each one to his taste.

REFRACTION OF THE EYE IN SCHOOL CHILDREN.*

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I HAVE thought that these few remarks upon the refraction of the eye in children may be of interest in view of the prominence that the treatment of school children has of late taken. Most of you here are acquainted with the methods used for testing the vision and recording the error of refraction of the eye, and you must forgive me if much that I say is familiar. It is certain that many of these children will come under your observation, and in some cases will present to you problems that may appear difficult of solution. It is with the object of, perhaps, being of some use in helping in the solution of some of these difficulties that I have ventured to read you this short paper.

The children are sent from school at all ages, from 5 to 15, for treatment of eye defects. It is a pity that in many cases we do not see them earlier, at the age of 2 or 3, in order that we may attack a squint at its inception, for it is at about this age of 2 years that the majority of convergent squints begin.

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