REFRACTION WORK IN GENERAL PRACTICE.*

BY

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REFRACTION work in general practice is, or ought to be, just the same as refraction work in specialist practice—the same principles are involved and the work should be done in the same way. I do not propose, therefore, to trouble you with the principles of refraction or the details of treatment of the various forms of refractive error. These can be found in any handbook of refraction, of which there are many, one of the best being Mr. Percival's little book entitled *The Prescribing of Spectacles*.

What I do propose to give you are some hints on equipment and procedure which I hope may be of some use to those who, like myself, are interested in the subject and have to do their refraction work in the time they can spare from the work of a general practitioner.

It will, I think, be easiest to give you the points I wish to make if I follow the patient from the moment he comes into the consulting room till the final moment when he is allowed to wear the glasses that you have tested and found to be in accordance with your prescription.

The first thing to do on his arrival is to note his name and address, age, and the symptoms that have brought him to you. For this purpose nothing is more convenient than the card index system. My own cards are the ordinary 5 in. by 3 in., but if I were starting over again I should use a larger size. The next step, if the patient has worn glasses, is to examine them and note what they are, and also who prescribed them. You can estimate their strength by neutralizing them with lenses from your trial case, finding the axis of astigmatism, if any be present, by holding the glass between you and the window frame and turning it round till you can see through it both the middle sash and the vertical mid-bar undistorted. But a much quicker method is to use the Geneva lens measure. As an instance of its use I had a patient lately for whom I had prescribed a pair of +0.5 spheres for constant wear. I was surprised to find that they were causing trouble. The glasses were neutralized by -0.5 spheres and their optical centres were the correct distance apart. I found, however, by using the lens measure that while one was an ordinary biconvex or plano-convex lens, the other was concavo-convex or periscopic. The optician was requested to give the patient two lenses of the same kind, and the trouble disappeared.

One point is worth mentioning with regard to the lens measure, and that is that the revolving hand is apt to work round a little with constant use to one or other side. It is advisable, therefore, before testing a lens with it, to place it on a plane surface—for example, on one of the sides of a prism from your trial case. If the pointer stands at zero all is well. If not, you must make the necessary correction from your subsequent readings when you are testing the lens. Having found by the lens measure the strength of the glass it is as well to neutralize it by lenses of opposite sign and see if vertical and horizontal lines can then be seen through it without distortion. If not, the probability is that a prism has been combined with the other lenses, and its strength can be found in the same way by neutralizing.

Before returning the glasses to the patient you should see whether the optical and geometrical centres coincide—again by the use of the window frame, or any convenient horizontal and vertical lines—and in any case should measure and note the distance between the optical centres. A straight steel millimetre rule is convenient for this purpose.

The next thing to note is any abnormality in the general appearance of the patient's eyes—epiphora, conjunctivitis, slight reddening of the corneo-scleral margin, etc.; and also whether there is any nystagmus or obvious squint. The room is then darkened and the eyes examined by focal illumination. For this purpose, and also for the indirect method of using the ophthalmoscope, the unmounted lens

that is sold with the ordinary Morton ophthalmoscope is not very convenient. It is better to have one a shade larger, of approximately the same strength (mine is +13), mounted in a ring frame with a ring handle. This lens is easier to hold for all purposes, and in the indirect method when examining the patient's left disc you can hold the lens with your hand on his forehead in such a way that your forearm does not prevent his right eye from looking towards your left ear. With the small unmounted hand lens this is almost impossible, unless you hold it below, and if you do you have not the command over it that you have over the ringed lens.

Focal illumination will show, among other things, corneal opacities, abnormalities of the pupil such as the Argyll Robertson pupil of tabes, or general paralysis of the insane; the tremulous iris that indicates a dislocated or extracted lens; the dilated and feebly reacting or immobile pupil of glaucoma; the contracted pupil of iritis; irregularities in the shape and size of the pupils, and so on. The size of the cornea and the depth of the anterior chamber are also worth noting. We are apt to imagine that the size of the cornea is much the same in all eyes, but anyone who has done a few cataract extractions or has made any use of Schiotz's tonometer knows that there is considerable variation in the corneal diameter. The foot-piece of the Schiotz tonometer, which is placed on the anaesthetized cornea, measures 10½ mm. across. In some eyes there is very little corneal margin to be seen when the instrument is in position, while in others quite a wide band remains uncovered. The importance of this point in refraction work is that an eye with a small cornea has presumably less adequate provision for the escape of aqueous into Schlemm's canal than the eye with a large cornea; and when you are examining such an eye and note that the anterior chamber is also shallow you should resist all temptation to dilate the pupil. Even a mild mydriatic like cocaine might be sufficient to produce an attack of acute glaucoma in such an eye.

The final point to notice in this part of the examination is the condition of the lens, and here a word of warning may not be out of place. The concentration of light on the eye in focal illumination is apt to produce a white appearance in the depth of the lens, and the inexperienced observer may mistake this for an opacity. Twice within the last few months I have seen patients in whom cataract has been diagnosed as the result of this examination—a mistaken opinion that a moment's inspection with the ophthalmoscope was sufficient to refute.

The next step in the dark-room examination is the inspection of the eye with the plane mirror of the ophthalmoscope. In this way faint corneal nebulae that have escaped notice in the previous examination are easily detected. They are important to note, for their presence if central will make a great difference in the patient's visual acuity and will readily explain his failure to read 6/6 when he comes to the subjective tests. Cataract, if present and central, is at once spotted; while the failure of the red reaction in one position of the eye would lead one to suspect a detached retina, a dislocated lens, or an intraocular tumour.

Then comes the examination of the fundus of the eye with the concave mirror and the hand lens—the indirect method. The disc, periphery, and macula are examined rapidly in turn, the clearness or otherwise with which the fundus is seen giving one an idea of the condition of the vitreous. This finishes the preliminary examination. It takes a long time to describe, but in a normal eye takes only a couple of minutes or less to carry out. If any abnormality is detected it can be further investigated by the direct method. If none is seen it is at least worth while knowing that the eye is apparently normal.

The next step, if you have an astigmometer, is to use that. They are unfortunately expensive instruments, running from £20 to £40 or more; but they are undoubtedly most valuable, giving you in one or two minutes information that may take you ten or fifteen to acquire by retinoscopy—namely, (1) the amount of corneal astigmatism present, and (2) its axis. Retinoscopy is then proceeded with in the usual way, the patient being seated with his eyes as nearly as possible one metre distant

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from your ophthalmoscope. The light may be either electric or incandescent gas, or even an oil lamp if nothing better is obtainable, but it must have a ground-glass globe, and it must be placed on a bracket which you can move both vertically and horizontally. It is adjusted to a position just behind the patient's head, either just above or close to one side; in either case it must be so obscured by his head that the light does not shine on the back of the lenses in the trial frames. The trial frame is then fitted and lenses inserted till the shadows are reversed. You can assure yourself that your correction is good by leaning slightly forward, and then somewhat back from your position of one metre distance, and noting how the shadows move in each position. If in one direction when you lean forward and the opposite when you lean back you may be satisfied that your lens is approximately correct.

One very important point is the direction in which the patient fixes his eyes. Theoretically he should look directly into the mirror, as it is the refraction in his visual axis that you want to find, and when his accommodation is paralysed by a cycloplegic he should do so towards the end of your examination when you have found his approximate correction. If his accommodation is not paralysed the pupil will contract too vigorously if he looks straight at the mirror for any satisfactory retinoscopy, but he should be told to look as close as possible to the top or side of your head. If you allow him to look a foot or two away you may get a beautifully illuminated pupil and much easier shadows to watch, but you may find when you come to the distance test that you are as much as two diopters out in your estimate.

The next step is to try the effect of the lenses you have found with the Snellen's types at 6 metres distance. It is convenient to have more than one set of types, as some patients, especially children of school age, very soon learn the letters off by heart, and when you come to their second eye may repeat them without really seeing them. The best form of type to get is printed on some material which is washable. Besides the test types you should have on your consulting room wall some form of astigmatic fan; and also Maddox's tangent scale.

In most consulting rooms there is a difficulty in getting the patient sufficiently far away from the types; 6 metres is approximately 20 feet, and few of us have consulting rooms of that length. The difficulty can sometimes be got over, if the room is fairly large, by placing the types in one corner and the patient in the opposite.

Another useful method in a small room is to place a mirror on the wall opposite the patient, while a special card of types, on which not the letters but their mirror images are printed, is hung above his head in such a position that the distance from his eye to the mirror, added to that from the mirror to the types, equals 6 metres. Another method is to make use of a passage leading into the room to give one the extra distance—the patient being seated in the passage and looking through the open door of the consulting room at the charts on its wall. Failing all these possibilities one can have a set of types in which the size of the letters is altered to correspond to the distance at which they are to be read.

The illumination of the test cards is an important point. If you use daylight your results from day to day in this climate are not comparable. A patient will read sometimes two or three more lines when bright sunlight is falling on the types than he will when the sun goes behind a cloud. The ideal thing is to use a dark room with a vertical series of lights, shaded from the patient, shining on the card in such a way that all the letters are equally illuminated. In any case it is advisable to use artificial light, as you can ensure your tests being always done under the same conditions.

The patient is now seated at 6 metres distance from the Snellen's types with a blank disc in the trial frame opposite his better eye. You test the worse eye first to prevent the patient getting too familiar with the letters in the lower rows. Opposite this eye you then insert any cylinder you may have found necessary by the ophthalmometer or the shadow test, and a spherical lens in hypermetropia which

you know to be too strong and in myopia one which is too weak. The patient then reads as far as he can. You then proceed to add *minus* spheres until you reach a point where a further sphere, though he may say he sees better with it, does not enable him to read any further. You then see if alteration in the angle of the cylinder improves his vision. If not, the next step is to use a crossed cylinder. You can do this by taking the 0.25 *plus* and *minus* cylinders from your trial case, holding them together with their axes at right angles to one another, and placing them in front of the patient's eye with one of the axes in the same plane as the axis of the cylinder he is wearing. If this is no improvement you try it the other way round. If he is wearing a *plus* cylinder and you find that when the axis of the *plus* cylinder in your combination is parallel to its axis he sees better, then his cylinder is probably too weak; if he sees better with the *minus* cylinder parallel to the axis of his cylinder, then his cylinder is too strong. You make the necessary alteration in the cylinder, test again with the weak *plus* and *minus* spheres, and then again with the crossed cylinders, till you have found the combination that gives him the best vision.

The crossed cylinders are a little difficult to hold in position exactly at right angles to one another and also with the axis of one of them exactly parallel to the axis of the cylinder in the trial frame—especially if the latter is not vertical or horizontal; the glasses are also apt to get dimmed by the heat of your fingers as you hold them. It is much quicker and easier to use Jackson's crossed cylinders—single lenses with cylinders of opposite sign ground on either side at right angles to one another. You can get them in any strengths—0.25 and 0.50 are the most generally useful. When you buy them you will usually find the axes of the cylinders marked on the glass either by scratches or by coloured dots, and neither of the axes as a rule coincides with the handle. It is worth while slackening the screw in the ring mounting with a small screwdriver (which, by the way, is a most useful implement to have in your trial case), and twisting the lens round till, say, the axis of the *minus* cylinder coincides with your handle. If you know that this is so, it is easy and quick to hold the crossed cylinders in the correct position in front of the other lenses. The other eye is then similarly tested, and then the vision with both eyes wearing the correcting lenses is taken and you see whether the patient will accept any additional *plus* spheres when both eyes are open.

The next step is to test the patient's near point with each eye separately while wearing the correcting glasses. If you find the amplitude of accommodation markedly less than it should be at his age you may suspect a spasm of the ciliary muscle—not such a very uncommon condition, and one which it is important to diagnose and treat, as it is responsible for a good deal of suffering. I had a patient recently, sent by Dr. Fairclough of Hexham, a woman of 35, who had lost one eye in infancy. She had been fitted with a *minus* sphere and cylinder by someone who had not suspected this condition, and for years she had been in misery with symptoms of eye-strain. I tested her under homatropine, but, not being satisfied with the result, made her use atropine drops for several days and then retested her. I then found, as I had suspected, that there had been a spasm of the ciliary muscle, and she had compound hypermetropic, not myopic, astigmatism. Her new glasses gave her complete relief from eye-strain and great comfort in near work, and she is finding, as her ciliary muscle gradually relaxes, that the dimness which she at first felt when wearing the glasses for distance is disappearing.

Having tested the patient's near point, it is advisable to put a Maddox rod in front of the correcting lenses in the right eye and test for any latent defect of muscular balance. Of these the most important is hyperphoria, the test of its presence being that when the rods are vertical the patient sees the red horizontal line either above or below the light in the centre of the tangent scale. When this is found the prism necessary to correct it should be found and noted. The rods are then placed horizontally in the trial frame and the patient tested for esophoria and exophoria—the vertical red line in this case being either to the right or left of the centre light. Practice varies as to whether

these defects should be corrected or not. As some of them disappear when the patient has worn the glasses which correct his refractive errors for some time, I personally do not correct them to start with. But if a patient who has given his glasses a good trial—say six weeks or more—still complains of eye-strain, and especially if he is troubled with diplopia, I retest with the Maddox rods and consider the question of prescribing prisms.

If the patient is over 40 he should now be tested with the near types to see what addition, if any, is necessary for near work. It is very important to find out exactly at what distance the patient wants to see—a short man with short arms will probably hold his book about 10 inches from his eyes; patients of another build will prefer it 13 inches away or even more; while a pianist requires vision at about 20 inches, and a laundress ironing at a table may want even more. The near vision addition would, of course, be different in each of these cases.

The chief mistake to avoid is giving the patient too strong an addition for close work. If you test the patient with a strong light behind him shining on the near types he is very likely to take a stronger lens than he requires, and he will probably complain when he comes to try the glasses afterwards that he feels they are "tearing the eyes out of his head." As a rough working rule for the patient who reads at 13 inches, the usual distance, we add +0.5 at 45; +1.75 at 50; +2 at 55; and +2.25 at 60—he should never require any stronger addition than this to his distance glasses.

At the same time it should not be forgotten that a patient after 50 gradually develops an acquired hypermetropia, so that his distance glasses require gradual strengthening. A man who is emmetropic at 50 may require as much as +2.25 spheres for distance when he reaches the age of 80, and, of course, his near glasses will have to be correspondingly strengthened. The point I wish to emphasize is that the addition to his distance correction for reading at 13 inches should probably never be greater than 2.25 at any age, with the possible exception of myopic eyes, as in them the range of accommodation is usually defective.

The next step, and a very important one, is to measure the distance between the patient's eyes both for distance and for near vision. The patient should wear his correcting lenses during this test and should, of course, fix a distant object when he is wearing his distance glasses, and a near when he is wearing his near glasses.

The patient is now ready for his prescription. One of the snags in writing this is, that there is so much confusion in the way the angles of cylinders are marked. The standard method is to make the left side of each of the patient's eyes as you look at him zero, and measure the degrees from that counter-clockwise. But you will find trial frames and prescription forms marked in all sorts of ways—zero sometimes at the temporal, sometimes at the nasal side of each eye; sometimes at the temporal side of one and the nasal of the other. If you have not a prescription form with a diagram on which you can mark the angle it is always advisable, after writing the strength of your cylinders and the degrees of the angle, to draw a horizontal line and then draw a line from one end of this to show roughly in what direction the angle is to be measured.

Before the patient goes you should give instructions as to whether the glasses are to be worn constantly or not; you should warn the patient (unless you have prescribed periscopic lenses) that he must learn to turn his head when he wants to see anything to the side, so that he always looks through the centre of his glasses; hypermetropes and anisometropes should be warned that they may require some weeks of constant wear before the glasses become comfortable; patients who are given cylinders at an angle for the first time should be warned that at first they will be troubled by straight lines not in the direct line of vision appearing distorted; while all patients, but especially children, should be advised to take their spectacles to the optician from time to time to make sure that the frames have not got twisted.

The final point is to insist that the glasses should be sent to you to be checked before the patient wears them. I have learnt the necessity of this by repeated painful experience. I have had patients complaining that the glasses did not

suit them in whom I have found the axes of the cylinders the opposite way to my prescription. I had a patient once for whom I took the trouble to work out a formula for periscopic lenses for use while playing tennis. It was only two years afterwards, when he came to see me about something else, that I found the glasses had been useless, and on examining them found the opticians had disregarded my formula and sent him ordinary spheres; I have had patients with anisometropia in whom the strong lens had been put opposite the eye that required the weaker. But the thing in which I find the greatest difficulty is in getting the lenses centred correctly. The oculist finds a frame that fits nicely on the patient's nose and looks neat, and he will often fit the lenses into this without any regard to the interpupillary distance. Glasses undoubtedly look neater when the lenses are not very wide apart, and there is no objection to the optician using such frames so long as he decentres the lenses outwards so that the distance between the optical centres is correct, but so far I have never seen this done. Almost always, unless specially ordered otherwise, the optician fits lenses of which the optical and geometrical centres coincide, though I have actually had a case in which the lenses were the correct distance apart, but for some obscure reason or other decentred lenses were fitted, bringing the optical centres much nearer than they should have been!

I lay stress upon this point because I believe a mistake in the centring of the lenses is often an unsuspected cause of eye-strain. This is not to be wondered at when you remember that a spherical lens whose optical centre is not opposite the centre of the pupil has the action of a prism. An error of only 4 mm. (1/6 inch) in the distance between the optical centres of a pair of +5 spectacles will have the same effect as putting a No. 1 prism before each eye. When weak lenses are concerned the prismatic effect of wrong centring, if only a few millimetres out, does not matter much; but when you have to prescribe strong lenses in either hypermetropia or myopia it is very important to satisfy yourself that the optical centres are exactly the right distance apart.

THE TREATMENT OF SEA-SICKNESS.

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RECENTLY, in a brief but fairly exhaustive review of the various theories of the causation of sea-sickness, Ribolla¹ points out that overstimulation of the vestibular nerve, with consequent irritation of the vagus, best meets the case. As he shows, sea-sickness presents the syndrome that may be observed in sensitive subjects on excitation of the vestibular nerve by the simple injection of warm or cold water into the external auditory meatus, or by means of a mild voltaic current. Perhaps the most exhaustive account of the part played by the semicircular canals in motion-sickness is that of J. Byrne,² which is extremely valuable for reference. Sea-sickness is not an affection *sui generis*, but a particular form of motion sickness, other variations of which are the nausea associated with aeroplanes, trains, swings, roundabouts, waltzing, etc.

The part played by the internal ear has been recognized for many years^{3,4} and may now be regarded as fully accepted. Portier⁵ recently gave a very good description, with diagrams, of the nervous mechanism involved. Pozerski at the Pasteur Institute, studying what Weiss⁶ calls "*ce petit accident des traversées*," induced it experimentally in animals by means of an apparatus capable of producing rolling and pitching motions. Several interesting points emerged. Fasting animals were found less susceptible than recently fed ones; many kinds were quite immune, and others soon acquired immunity. As showing the psychological factor, a dog, after the first experiment, on being brought into the room was sick at the mere sight of the machine.

In addition to anticipation and dread, other factors such as optic vertigo—as pointed out by Erasmus Darwin,