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1908 Trans. Opt. Soc. 10 5

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ADVANTAGES AND DISADVANTAGES OF OBJECTIVE AND SUBJECTIVE METHODS OF SIGHT-TESTING.

By W. J. WRIGHT.

Lecture delivered on January 21st, 1909.

I claim nothing original for your attention, wishing only to give an account of my experience as an optician, that it may help in deciding which is the best method (within our limitations) of satisfactorily testing the vision.

As you are aware, there are many methods described in the books for discovering whether the eye requires assistance by means of lenses, all of which are classed under two heads, objective and subjective.

The former includes all those methods by means of which the observer is able to estimate the kind and amount of ametropia, by observation alone, and the following are some of them: Corneal reflex (Placido's disc), the ophthalmometer or keratometer, direct ophthalmoscopy, indirect ophthalmoscopy, retinoscopy, and the stigmatometer.

The latter includes all those methods whereby the optician is able only to estimate the kind and amount of ametropia from replies to questions judiciously asked. The following are some of them:—Confusion letters, stenopaic slit, test charts and lenses, pointed line or perforated disc for astigmatism, Pray's letters for astigmatism, Scheiner's test, cobalt blue glass test, Thompson's ametrometer, pin-hole test, Tweedy's optometer, and the stigmatometer.

Besides these tests for refractive errors, we have the perimeter for testing the field of vision, Maddox rod, grooves and double prisms, the various phorometers, the optomyometer, the tropometer for measuring rotation of eye and the prism verger. These last named instruments, with the exception of the perimeter, are for testing the ocular muscles, and will not be dealt with in this lecture.

Refractive errors can be classed under three heads, as hypermetropia, myopia, and astigmatism; and I wish to deal with the methods of testing these three defects separately, with the endeavour to select that method most suitable to the conditions associated with each particular defect.

Hypermetropia is a refractive error which, for the sake of simplicity, can be considered as an eye too weak, but owing to the function of accommodation, the eye can, with muscular effort, be raised to the proper strength, with the result that good vision, generally normal, is obtained. Owing to the long hours spent in close vision as compared with distant vision, this muscular effort often exceeds the amount required to overcome the hypermetropic condition, even when wishing to look in the distance; and when such is the case, we call it spasm of accommodation.

Now, I am convinced that the majority of hypermetropic eyes are more or less bordering on spasm of accommodation, or, in other words, they are unable to instantly relax their accommodation, even with the persuasion of a convex lens. It is therefore essential not to make the eye accommodate until the very end of the test. With this conclusion, if accepted, we must at once condemn all subjective tests unless the fogging system is adopted. The objective tests I have mentioned, with the exception of retinoscopy, would also have to be discarded, unless made in conjunction with the fogging system; and even retinoscopy would be more reliable

therewith. I will ask you to assume, therefore, lenses. The best procedure to overcome the difficulty of accommodation is to seat your client in the chair and, without taking the V.A., put in front of the eyes your fogging lenses. I speak of the eyes and lenses here in the plural, for I have a way of fogging the vision which that all tests are made in conjunction with the fogging system.

The first subjective test from the list suitable for testing hypermetropia, is the test chart and may be of interest. Instead of putting a fogging lens over the eye to be tested and a blank disc over the other, I place a fogging lens over both eyes, each lens being combined with a prism, which I place base-in. My reason for doing this is to make the eyes diverge; and the nerve stimuli causing the divergence will then tend to relax any accommodation similar to the convergence exciting same. When the fogging lenses are in position you may direct your client to the chart and determine the V.A. at six meters; and the same thing can be done in 90 per cent. of cases without stimulating the accommodation. The test with the charts and lenses in this way is, in my opinion, as satisfactory as any; but without the aid of the fogging system, an optician can never be certain of his results.

The next test on the list is Scheiner's disc, which, although obsolete, is, nevertheless, quite as accurate as the test with the charts and lenses, if used in conjunction with the fogging system; but without this adjunct, it is equally uncertain.

The cobalt blue glass test is fairly certain with the fogging system, but very uncertain without. I must say I have found it a most unreliable test, especially with people not knowing the theory upon which the test is based; and my own practical experience urges me to advise opticians not to attempt testing such with it.

Thompson's ametrometer is, in my opinion, a very ingenious test, although I must admit I have not at any time used it, otherwise than experimentally—I think from the simple reason of it not having been brought to the front sufficiently. I am not sure that everyone present is aware of the principle of this test, so will briefly explain it, with the hope that those who do already know the facts will pardon me. From the diagram (illustrating) you will see that this test consists of two lights of a definite size which form diffusion circles on the retina in ametropia. One light is a fixture at the end of a bar, and the other can be moved along same. When the circumferences of each circle of diffusion are just touching, you read the degree of error, in diopters, from a scale marked on the bar. By rotating the bar with the lights in different meridians, you are able to determine the degree of error in any particular one. This should also be used with the fogging system, or otherwise it will break down in cases of hypermetropia.

The next test to be dealt with is the pin-hole which, as you all know, is an opaque disc with a small hole in the centre, through which you direct your client to look. The chief use that has been made of the pin-hole is, I believe, to distinguish between errors of refraction and disease as the cause of low V.A.; and it is rarely considered as a means of estimating the kind and degree of ametropia. It can, however, be used to give fairly accurate results in this sense. If you look at a black dot on a white surface at a distance of six meters, through a pin-hole, and move the latter up and down, in front of the pupil, the dot will appear stationary if the eye is emmetropic, will move against the movement of the pin-hole in hypermetropia, and with the movement of the pin-hole in myopia. Although a subjective test, I find this is unlike the others inasmuch as that, if one is hypermetropic to either a low or high degree,

he will get movement "against," the use of accommodation seeming to have no influence. You will readily understand, therefore, that with respect to the accommodation, it is superior to all other tests; but it is seldom you find a client sufficiently intelligent to observe the direction of the movement, and this alone is quite enough to prevent it from becoming a popular test.

Twedy's optometer is the next test on the list, and must, if anything, be condemned to a greater extent than the previous tests, because your client has to converge, which alone is sufficient to excite the accommodation.

The stigmatometer is an instrument which, had accommodation been an easy item to deal with, would have certainly been considered one of the best; but accommodation not being easily overcome, it is not, I find, used much in England. Like the optometer, the use of the instrument just named necessitates your client looking at something within infinity, which will at once excite the accommodation.

It will be seen, therefore, that with all the subjective tests, with the exception of the pin-hole, an optician is greatly handicapped; and with the pin-hole you have even greater difficulty to make your client understand what you want.

The objective tests mentioned—*i.e.*, direct ophthalmoscopy, retinoscopy, and the stigmatometer—are all similarly robbed of their usefulness. It is therefore essential that no test should be attempted, no matter which method you use, unless some fogging system is employed.

I will eliminate from the list various tests which, from practice, I have found the least reliable, and will do so in the inverse order of their value, briefly stating why:—

Pin-hole test.—Great difficulty of the client to observe the movement with or against.

Cobalt blue glass test.—Trouble of see

dation and difficulty of client to observe the phenomena.

Tweedy's optometer.—Trouble of accommodation accentuated by the use of convergence.

The stigmatometer.—Trouble of accommodation accentuated by the use of convergence.

Scheiner's test.—Trouble of accommodation and difficulty of an imaginary line joining two perforations in the disc, bisecting the centre of the pupil.

Thompson's ametrometer.—Difficulty of accommodation—and that a little intelligence on the part of your patient is required.

Test charts and lenses.—Trouble of accommodation.

These are the conclusions I have come to with respect to the subjective tests for hypermetropia. As for the objective tests, I submit the following remarks:—

Indirect ophthalmoscopy.—Here is trouble of accommodation; and only a *very wide* approximation of the degree of error can be arrived at, even after long experience.

Direct ophthalmoscopy.—Trouble of accommodation in both the observer and the observed, and insufficient arteries to decide if only simple hypermetropia.

The stigmatometer.—Trouble of the accommodation accelerated by convergence.

Retinoscopy.—Trouble of the accommodation.

I therefore conclude that the best method of testing hypermetropia is with the test chart and lenses, for a subjective test, and with the retinoscope for an objective test; and as I consider that each should be adopted, so that one may check the other, I have endeavoured to perfect myself as much as possible in same, even to the exclusion of other tests, with the exception of experimenting.

What I have mentioned about accommodation as a check to the straightforward testing of hypermetropia, applies to a less extent, in com-

parison, to the degrees of myopia, up to, say, 3D; but in myopic cases of over this amount you can expect to get a straightforward test. The fogging system is not required, and most of the tests mentioned in the list will serve equally well. I will, as before, tabulate same in inverse order of their value, in my own opinion, and briefly state my reasons:—

Subjective Tests.

Pin-hole test.—Great difficulty of client to recognise the phenomena.

Cobalt blue test.—Difficulty of client to observe phenomena.

Scheiner's test.—Difficulty of bisecting the pupil.

Thompson's ametrometer.—Some little intelligence of the patient required.

Tweedy's optometer.—Possibility of accommodation due to the convergence.

Stigmatometer.—Possibility of accommodation due to the convergence.

Test charts and lenses.—No disadvantage.

Objective Tests.

Indirect ophthalmoscopy.—Only a very wide approximation of degree of error can be arrived at even after long experience.

Direct ophthalmoscopy.—Trouble of accommodation in both the observer and the observed, and difficulty to decide if only simple myopia.

Stigmatometer.—Possibility of accommodation due to convergence.

Retinoscopy.—No trouble.

While, therefore, one has a good selection of tests for myopia, I think, on consideration of them all, your decision will again be given in favour of the test charts and lenses for the subjective test, and the retinoscope for the objective tests.

Although astigmatism can be considered as a definite amount of hypermetropia or myopia in

a particular chief meridian, and a greater, or less, degree of the same or opposite power in the meridian at right angles—also as accommodation is a factor to be considered in a similar way in all kinds of hypermetropic astigmatism, and in low degrees of myopic astigmatism—you will, I believe, if you agree with me as to the best test for simple hypermetropia and myopia, agree also that the same tests will be best in astigmatism.

The chief cause of astigmatism, however, being the faulty shape of the cornea, has enabled other tests to be made, which deal with this exterior portion of the eye alone; and the optician's bogey, accommodation, does not affect the results in any way. All tests of this description depend on our being able to use the cornea as a convex mirror; and the simplest test is the Placido disc, which will only, however, tell you that the curvatures of the cornea are different, and not denote the amplitude of the difference.

The other tests are the ophthalmometer, which term I use to denote a two-position instrument, and the keratometer, which is a one-position instrument.

Of the former there are several different makes, the Inskeep being perhaps the most favoured, although the Ettles-Curties instrument, being of English manufacture, with every care taken to make it a perfect instrument, will, I hope, soon come to the fore, at least in England.

The latter is, as you are all aware, the latest invention for measuring the curvature of the cornea, and has so recently been exhibited and explained to members of the Optical Society by our President, that no remarks of mine are needed. Speaking, however, of ophthalmometry or keratometry generally, I would mention again that only the cornea is considered; and although astigmatism may seldom be due to other reasons than the elliptical shape of the cornea, the findings of the ophthalmometer

should never be relied upon without corroboration by means of some other test.

Charts having lines composed of points or perforations, also charts containing letters of similar forms, and Pray's letters, are specially designed for indicating the presence of astigmatism; but the usefulness of all these is restricted by reason of the function of accommodation, and I find their particular design is of no more value than the ordinary fan type.

The stenopaic slit is a favourite test for astigmatism in conjunction with the fan of lines, but it has difficulties with respect to the trouble of rotating it in front of the eye, to obtain the best or worst meridians; also there is the doubt a client has in deciding the exact positions of those meridians. In mixed astigmatism, if the fogging system is not adopted, it is the best of our subjective tests. Employing the fogging system, however, enables one to test mixed astigmatism with much greater ease and with equal accuracy, besides being a straightforward test; for the refractive condition of the eye is converted from mixed astigmatism to compound myopic astigmatism.

You could criticise the various tests we have, almost indefinitely, because, practically speaking, we have not really an infallible one when used by itself; but I think that retinoscopy with the fogging system, also the charts and lenses, are as good, if not better, than any tests yet devised, and if properly manipulated, will secure as good results as can be obtained when the eye is under the influence of a mydriatic.

The best form of dealing with your set of trial lenses is by means of circular discs to contain the different power lenses, which can be rotated one after another in front of the eye. There have been various attempts to enable this to be done, but the best, and practically perfect, form is that known as Fournet's refractometer. The essential points about it are, that there are two discs, one containing sphericals

and another cylindricals, which can be used separately or conjointly in front of the client's eye; and after setting the cylinder at a particular axis, each cylinder of a different power, as it is rotated into position, will assume the same axis.

Having come to these conclusions some years ago, I have endeavoured to get the best conditions for testing with the retinoscope and with lenses, and at the present time I have a reversed chart which includes the Snellen's letters, the astigmatic lines and scale for testing the phorias, illuminated with four Nernst lamps each having a power of 36 candles, so that the illumination on the chart is about 144 units. This may seem rather high, but illumination does not make much difference to the V.A. between 40 and 200 units, and the arrangement of the lights gives as equal an illumination over the chart as I have previously been able to obtain. It is, however, still far from perfect, and a lino-light with a metallic filament would be as near to perfection as possible. I also have a Nernst lamp entirely covered, with the exception of a circular aperture three-quarters of an inch in diameter, just above my client's head, and bisecting the scale for testing the ocular muscles, for which purpose I use it, and also for retinoscopy. There is a particular astigmatic chart which I should welcome if it was attached to the letter type and muscle scale. It is called the Jameson facile astigmatic chart; and when I used it a great deal some years back I obtained very good results. I have here a diagram of it, and you will readily see the advantages.

Although one may select those tests which he thinks the best, there are many accessories and devices tending to make the results more accurate. It often happens, also, that however accurate you may be with the test, you may, if not careful, cause trouble by reason of the shape of the lens you prescribe; for it must be remem-

bered that as the inner surface of the lens is, theoretically, always in one position in front of the eyes, you are dealing with the back focus of the lens. Also, care must be given to the presbyopic correction in cases of high degrees of astigmatism, and in anisometropia when there is a great difference in the power of the two eyes.

It is said that the greatest safeguard in detecting spasm of accommodation is the P.P., and, undoubtedly, such is the case, but it is very difficult to tell in low cases of hypermetropia and myopia, as to whether the P.P. is within or beyond the normal distance. As an example, if the age of your client was 20 years, the P.P. should be 10 cm. if emmetropic, and 11 cm. if hypermetropic by 1D. Now, I think you will agree with me that it will be very difficult to tell whether the type is read at 10 or 11 cm. If, however, you place a minus 6D lens in front of the eye, the P.P. of your emmetrope will then be 25 cm. and of your hypermetrope at 33.3 cm. ; and I think you will be better able to judge if the print is held within or beyond the normal.

With these remarks I will conclude, thanking you for the indulgent manner in which you have listened to what I have had to say ; and I look forward to hearing the experiences of others present, with the hope of improving my present system of testing.