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ON TESTING ASTIGMATISM.

DISCUSSION INTRODUCED BY DR. R. S. CLAY,

4th February, 1915.

DR. REGINALD S. CLAY said : It is quite possible that the method which I am going to suggest for testing for astigmatism is known to a good many of you. It is one I have explained to people for some years, but I have never actually seen it in print anywhere, and I do not think it is as well known as it deserves to be. To make it quite clear, let me begin in this way. Supposing there is a hole in a piece of wood and a wooden peg that fits the hole. If both the peg and the hole are perfectly circular the peg will turn round smoothly, and will be no tighter in one part than another. Now, supposing that either the peg or the hole is not quite circular, but oval. For instance, suppose the peg is not quite circular. If the hole is perfectly circular, although the peg does not fit anywhere, it fits just as well in one position as in another, and it does not bind in one place more than in another. Or if the peg is circular and the hole oval; again it will not fit, but it will turn round smoothly in the oval hole, and it will not bind anywhere. But if both peg and hole are oval, the peg will bind twice and fit twice in each revolution.

That is the principle of a method that I have found exceedingly valuable in convincing people that they have slight astigmatism. Suppose a person has quite small astigmatism, say, one axis, the vertical axis is $\frac{1}{2}$ D. stronger than the horizontal axis; if that person looks at either a horizontal or a vertical line within his range of accommodation he can see it clearly, and if he is asked whether a horizontal or a vertical line is most indistinct, it is quite possible he

will say that he can see them both clearly. But if a weak cylindrical lens, say a $\frac{1}{2}$ D. or 1 D., is held in front of his eye and turned round in its own plane (he may be told to begin with that he will very likely find that the lens will make his vision worse wherever it is, and he is rather pleased if it does not), he is quite willing to confess that he can see better through the lens in one position than in another. It is obvious that if it is worse in one position than the other it is a case of the double oval; since a cylindrical lens combined with his eye can only produce worse vision in one position than in the other when the eye also is unsymmetrical. I have always succeeded in convincing a person by that experiment that he really has astigmatism. I had a case only last night. I noticed the eyes of a student there looked tired, and the lids inflamed, and I asked her whether she was troubled with headaches. She confessed that she was sometimes. I said, "Is there anything the matter with your eyes?" "Oh, no," she said, "there is nothing at all the matter with my eyes." I dare say if I had showed her an astigmatic chart she would have said she could see all the lines clearly. She could see them in the way she always had seen them. She may have always seen one of them a little hazy, and she is accustomed to a vertical line as a hazy one. Just as you associate a certain smell, a lemon, for instance, with a certain taste, so she associates a hazy line with a vertical line, and is not going to confess that she cannot see it clearly. But when I had put a cylindrical lens in front of her eye she agreed that the vision was much worse with the lens in one position, and I easily convinced her that her eyes were not symmetrical.

The method has this advantage—that the effect of the extra cylinder cannot be overcome by an effort of accommodation. If one meridian is already, let us say, a diopter stronger than another one, and a $\frac{1}{2}$ D. cylindrical lens is

added so as to increase the difference, no effort of accommodation can prevent it reducing the acuity. While if it is turned to the opposite axis the accommodation enables the patient to focus properly. Quite small type should be used (the ordinary reading test type), which will become sufficiently indistinct with the double cylinder to show the person the lowering in acuity produced. I have always found it quite easy first of all to see if there is slight astigmatism present, and, secondly, to convince the patients by an appeal to their common-sense, as they can appreciate that their eyes cannot be symmetrical if a rotation of the lens produces any change in their acuity.

On Methods of Sight-Testing.

I desire to offer two criticisms of ordinary sight-testing. First of all, I believe there are still a good many people who use the clock face chart for astigmatic testing. I have found persons who have argued that if the axis of astigmatism is along either of the groups of lines, then it is quite as good, perhaps better than, the fan test, and if the axis of astigmatism lies between two, then it can be located by the comparative indistinctness of the groups. I thought this was quite right until I happened to try it on myself, and I find with my right eye, by estimating the relative haziness of the two lines, that the axis of astigmatism is from 5 to 10 degrees away from the position that I get with the fan. I do not know how to explain it. I can only suggest that the difference is due to a physiological cause.

One other thing. Whilst I believe everyone who does sight testing tries, when he has obtained the approximate correction, whether there is any improvement with a plus or minus $\frac{1}{4}$ D. spherical lens, I am not sure that there is the same anxiety to get the astigmatism correct to the last $\frac{1}{4}$ D., and in my opinion the astigmatism correction is much the more im-

portant. If there is just a little astigmatism left the eye is probably continually accommodating backwards and forwards, as if it looks at a horizontal line it sees that best with one accommodation, and if next to it there is a vertical line it sees that with a slightly different accommodative effort, and as a result the person undoubtedly gets a headache. So that, really, even more care should be exercised in obtaining the correct cylinder than the correct sphere. I therefore suggest that after the approximate correction has been found, a weak cylinder should invariably be held in front and turned round; if there is still a slight cylindrical error uncorrected, when the cylinder adds to that error the patient's acuity will be lowered as compared with the acuity obtained when the cylinder is rotated through a right angle, and it will indicate that there is still some astigmatism left uncorrected.

Discussion.

MR. F. W. DADD said he had not tried Dr. Clay's method himself. He thought opticians generally really did try to correct the smallest amount of astigmatism, and, having obtained the approximate amount by one method, usually tried the addition of weak plus or minus cylinders to see if any improvement in visual acuity could be made. For his own usual method of testing he always tried to keep the eye being tested back in its vision until what he considered to be the whole of the astigmatic error was corrected, viz., to keep the accommodation suspended until the astigmatism was cleared up.

MR. H. FIRTH said there was one point which had never yet been threshed out, and that was whether it was possible to accommodate for astigmatism. Could the ciliary muscle receive innervation in certain meridians so that an astigmatism of the crystalline lens would be produced and so neutralise that of the cornea? If the acuity was not very good it was quite pos-

sible that the patient would accommodate for the circle of least confusion, which, after all, was the nearest approximation to a point image in the astigmatic pencil, and in that case all the lines of a fan or the letters of a test chart, would be seen equally indistinct. Therefore, as a preliminary test for astigmatism, he did not see exactly how the rotation of a cylindrical lens was going to help. On the other hand, as a final test in cases of good acuity, he thought the rotation of a very weak plus cylinder, or, better still, a "Jackson" cross-cylinder (plus in one meridian and minus in the other), would certainly help them to arrive at an exact astigmatic finding.

MR. W. A. DIXEY said one point had struck him as rather interesting in listening to Dr. Clay. Everybody was familiar with the history of fatigue in connection with slight astigmatism, and it was quite possible (he had not seen it suggested before) that it might be due to the point Dr. Clay had suggested, namely, the constant operation of the accommodation in accommodating first to horizontal and then to vertical lines. It was a little fanciful, perhaps, but there was something in it.

THE PRESIDENT: It has frequently been suggested.

MR. DIXEY said he had not seen it. At any rate, the two directions were at right angles to each other, and it did not matter whether they were horizontal exactly; there had been variations in accommodation in any case.

THE PRESIDENT said that the method described by Dr. Clay was old wine in a new bottle, if he might say so. The oldest and perhaps the best clinical method of estimating astigmatism quickly was trial rotation of cylinders. When one asked a person to tell the difference in distinctness between the lines at right angles to each other, one was asking their opinion, and a person's opinion was often very much at fault, more especially if he was not accustomed to

scientific observation. It was very much easier to test, quickly and accurately, in the case of a person accustomed to scientific observation than in the case of a person who had never learned the meaning of the term. He thought, therefore, they should eliminate matters of opinion as much as possible. They could get what was required by ascertaining the smallest size of type that could be read. That was why one passed beyond the 6/6 standard in testing. If a person had a low degree of astigmatism something was sacrificed in the visual acuity—it might be one per cent., two per cent.: it did not matter—something had gone; the astigmatism could not be diagnosed, and need not be corrected unless there was this shortcoming. Let them assume that the case was one of an extremely low degree of astigmatism—say, an error of $\frac{1}{4}$ D. That person could read 6/6 but not 6/5. They would “rotate their oval peg over their oval hole” until they found it fitted exactly; when the meridians were in alignment and co-axial the patient could read 6/5, but when at right angles 6/6 was blurred, because they had doubled his error. So that one did not ask for the patient's opinion; one simply took them to the extreme limit of vision needed and then ascertained whether the cylinder would extend it. They were tested on a number of lines all in different directions, these lines constituting the integers of letters. Another point which arose was about the relation of astigmatic and spherical error. He quite agreed as a general principle that the astigmatic error was the one which would cause most trouble, but could not make a golden rule about it, because it must exist in certain proportions. If the spherical error was great, for instance, 3 degrees of hypermetropia, with half a diopter of astigmatism, it was the spherical error that was worrying the person. One could not lay down a law, but he agreed that if one of the two had to be dispensed with, as a rule

one would go for the correction of the astigmatism. Finally, the old vexed question of sectional accommodation had come to the surface again, and one could only surmise about that. One observer said that he had worn weak concave cylinders all day long and for several days, and he had never succeeded in making the lines of the star chart equal, which he would have done had he been able to exercise any sectional accommodation at all. But then they were surrounded with clinical evidence, for instance, that people of low degrees of astigmatism suffered much more from asthenopia than people with high degrees. How was that to be explained otherwise than that they were struggling to overcome it? The only trouble with regard to sectional accommodation was that there was no definite proof that it really had taken place.
