**An alleged defect of the prisoptometer / by H. Culbertson.**

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# AN ALLEGED DEFECT OF THE PRISOPTOMETER.

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It has been stated to me, that,in correcting ametropia with the prisoptometer,the correcting glass should be placed *next to the eye*

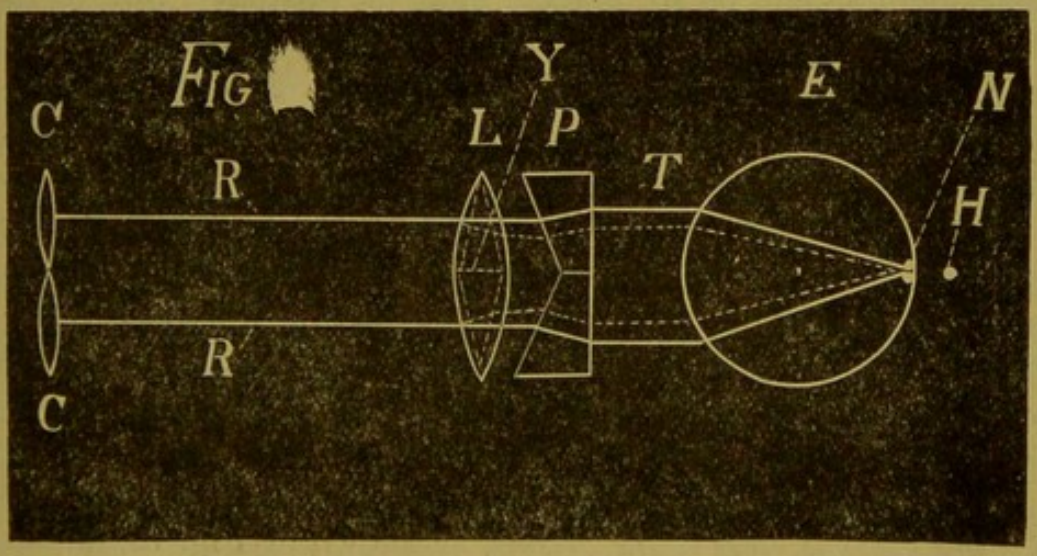


FIG. 12.

of the observer, and not upon the *distal* side of the prisms and

eye-plate, as now arranged in this instrument. This subject may be illustrated by the following figure, in which T is assumed to be the proper point to apply the correcting lens by the objector, instead of L, the location of the correcting glass as now arranged in said instrument. At C C′ is represented, the circle C and its false image C′, which are placed and seen at a fixed distance given with each instrument, from four to six metres, from P, the double-prisms, the apices of which latter are placed in contact. The heavy rays of light RR′ from CC′ are parallel, and supposing the + lens L removed, then these rays reaching the prisms at P, will be refracted outward, toward the base of the prisms, and after leaving the prisms P, will again become parallel and thus, incident upon the cornea will be brought to a focus upon the retina in the emmetropic eye E as seen at N. When this occurs the inner margins of CC′ and the little circles as shown at N will be tangent. The distance from P′ to CC′ is so arranged or adjusted that this contact shall result in the normal eye at CC′ and N. It is evident that to obtain this contact the rays of light must be parallel and reach the cornea of the eye E parallel, else tangency will not obtain. It is maintained that the eye, in relation to this instrument should be so placed, that the distance, from L to the cornea E, should be thirteen millimétres, or about half an inch. When the eye is closely applied to the prisms, its cornea is about that distance, (that of L to E) in the instrument as now manufactured: But still it is held by one party that L, the correcting glass, should be placed at T. To do this the proximity of the patient's face would be so close to the prisms as to inconvenience the oculist and patient by the frequent removal of the face of the latter, and as the breath of the latter would cloud the trial lenses by breath-moisture, and hence the object-circles would be obscured.

The problem then is, does the position of L, when the correcting *glass is close to the prisms*, as shown in Fig. 12, impair the obtaining of the true correcting glass sought. It must be restated, that when the correcting glass L is *not in situ*, in the instrument, the prisms P cause rays of light incident upon the cornea to be parallel.

The practical test of our subject is as follows, and can be demonstrated by all who have the prisoptometer, that it is immaterial how close or far from E, the eye is from the prisms P to the right of the prisms, and that it is immaterial whether the correcting glass be placed at T or L.

For example let an ametrope with =D 1.5 of hyperopia be the subject. The object-circles, CC′ are seen apart, and on placing +D.1.5 sph. at L, they become taugent, the eye E being close to P, the prisms. If now this+lens be transposed to T the object-circles will still be tangent. In the position of L or T, the images of the object-circles still touch in the now corrected eye, and in either location of the correcting glass at L or T, if the eye be withdrawn to the right from the prisms, the circles will still be seen in contact. Even if we remove the eye to the right six inches the images are still seen to touch. And again if we place the eye at six inches to the right of the prisms and apply the +D 1.5 spheric at thirteen millimétres from the cornea, the object-circles will still touch.

These practical experiments denote that the correcting glass has, so far, been obtained, but mainly, illustrating our views, that it is immaterial whether the correcting glass be placed at L or T, or if the eye be close or more removed to the right from the prisms.

It is however important that the eye be close to the prisms as a clearer view will be obtained of the object-circles, through the aperture of the instrument on the T side of the prisms, and the head will be more immovable placed against the instrument.

Why is the position of the correcting glass in the sense we are now considering, immaterial, whether it is placed at L or T? In a word the answer is that the rays of light reach the cornea parallel even when the correcting glass has been applied, and the rays so approximated to the axial line of the eye; that whereas they were apart and not in focus at N, but tending to a focus at H, Fig. 12, now when the correcting glass is applied, these rays are caused by this glass to approximate so much nearer to the axial line of the eye as to enable *this hyper-*

*opic eye* by its refractive power, defective as this is, to bring to a focus such induced parallel rays. This is illustrated by the dotted lines in Fig. 12, in which it will be seen that these punctated lines reach the cornea parallel, and that these lines are so much nearer and are parallel to the axial line of the eye, that even *its* defective refraction is now sufficient to enable the eye to induce a focus upon the retina, because said lines are less distance apart from each other.

It will be seen at a glance, that it is immaterial whether this correcting glass be placed at L or T, for if at T the prisms will first cause divergence, and then subsequently the + glass will induce approximation of the rays. If the + glass is placed at L the order of refraction will be reversed, but the result will be the same, *i. e.*, parallel lines incident upon the cornea.

So far as the refraction of the prisms is concerned, the rays are always parallel when the correcting glass is *not* in position, and by the correcting glass, the normal parallel rays of the instrument are brought nearer to the axis of the eye, the dark lines becoming the dotted lines, (as see Fig. 11,) and enabling the power of this hyperopic eye, to focus the rays of light upon the retina at N. It is immaterial what the power of the correcting glass may be, this parallelism of the rays of light will be induced when the inner edges of the object-circles CC′ shall have become tangent.

It is also probable that this correcting lens, L, acts as a double-prism, with base to base, as see Y, Fig. 12, and denoted by the dotted lens within the area of L.

The fact would seem to be, that with the prisoptometer, we are by the application of correcting glasses, simply acting upon the prisms P, and causing a variation in the position of the normally parallel lines of the instrument. As the degree of hyperopia increases, so more and more will the parallel (dotted) rays be brought closer to the axis of the eye by the proper correcting glass, acting, probably, as prisms, with their bases applied as seen in Fig 12. If these views are correct it is immaterial where the correcting glass is applied, at L or T.

But it should be stated that it is of *great* importance that the correcting glass be placed *close* to the prisms at L, for if removed beyond 13 millimétres to the left of the prisms P there will be error induced both in + and — from glasses, their separation to the left from the prisms. In fact these prisms, as arranged in the prisoptometer seem to act as does the eye, when correcting glasses are applied to it, increasing the power of convex glasses and diminishing the size of the image by concave glasses by the removal to the left of the lenses from the eye or prisms.

If the defect is myopia, see Fig. 13, concave glasses acting

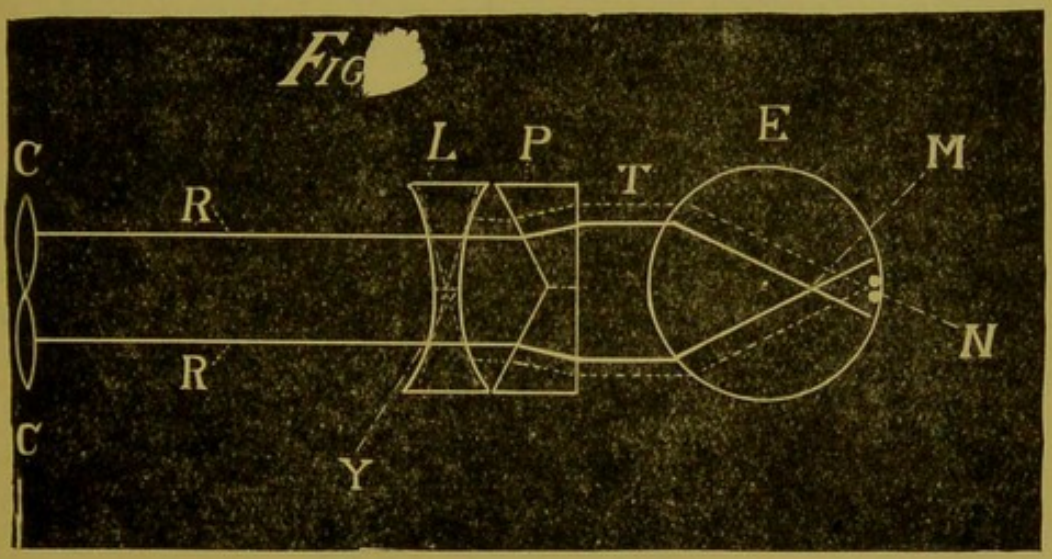


FIG. 13.

as prisms, their apices applied to each other as seen at Y, Fig. 13, will cause the dark parallel lines RR′ to be removed further from the axial line of the eye, and to take the direction of the dotted parallel lines incident upon the cornea, and hence the focus, M, of the ametropic eye E, will be cast posteriorly upon the retina as represented at N, Fig. 13.

As the principle is the same as expressed above as to hyperopia, only the negative trial glass acts the reverse of the positive lens, spreading in lieu of approximating the rays, the same conclusion may be drawn as to the position of the glass at L or T as has already been explained above in

hyperopia, and hence it is not necessary to restate what has already been written above. A reference to Fig. 13 will explain all that need be said as to the location of the correcting glasses in myopia with the prisoptometer.

If our theory is a fact, then it may properly be concluded from the foregoing considerations that, the trial glasses should be placed at L, (and not at T,) close to the prisms, P, as now placed in the prisopmeter, in correcting all forms of ametropia with this instrument.


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