HETEROPHORIAS AND INSUFFICIENCIES: A CLINICAL STUDY

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A CLINICAL STUDY

BY

H. H. SEABROOK, M.D.,

SURGEON, NEW YORK EYE AND EAR INFIRMARY, ETC.

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CHAPTER I.

GENERAL CONSIDERATIONS AND METHODS OF TESTING.

THE class of cases to be considered here has been recognized as having had an existence since the dawn of modern ophthalmology. Von Graefe attempted to solve the problems they presented, and although he furnished some valuable ideas for his successors to work upon, his knowledge upon the subject would be a poor equipment for an ophthalmologist of to-day. Donders saw the fallacies of the work being done in this field, solved in general terms the problem of accommodative asthenopia,

and found that "as soon as insufficiency of the internal or external recti muscles in binocular vision threatens to give rise to muscular asthenopia, it is of importance that the mutual distance of the glasses should not aggravate this but rather counteract it." If spherical glasses are insufficient, we are to combine with prisms or operate according to Von Graefe. There is agreement with Helmholtz's statement that displacement of glasses in a vertical direction causes more asthenopia than the same amount of lateral displacement. Except for the operative method indicated, the statements here made are entirely sound, but cannot be said to suffer from over-elaboration; they seem, however, sufficient to more than cover what is usually done for muscular asthenopia to-day in practice upon the European continent. In England signs of interest began to be manifested regarding these cases over fifteen years ago, and thanks to the work of Maddox and others many principles of value were evolved. Previous to this, Stevens in America had succeeded in attracting attention by means of his work, his highly enthusiastic followers, and his bitter opponents. A portion of his nomenclature came into general use, and is here followed. *Orthophoria*, muscular balance; *heterophoria*, tendency to deviation; *esophoria*, convergence tendency; *exophoria*, divergence tendency; *hyperphoria*, upward tendency. These terms were

taken to be equivalent to and supersede the old ones of insufficiency of the interni and externi, even Duane, whose masterly classification of these conditions has earned deserved recognition, taking this view; yet heterophoria means merely a tendency of the fixation lines away from the object of fixation, while insufficiency means lack of power. The old terms for exophoria and esophoria were dynamical divergence and convergence. It is the intention of the writer to show that certain forms of heterophoria may be due to errors of refraction or other optical defects, others to habit, others to the nervous system, and others still to muscular spasm, excess, or insufficiency. Much has been written upon this subject in addition to that so briefly mentioned, some of it of value, and the writer proposes to treat all of the authors in the most impartial manner, as he appropriates their ideas whenever he can make use of them, without regard to their source. He has no instruments to exploit, no special method of treatment to push, no new general disease which he has cured through the eye muscles. If, in spite of this, an original idea or so should creep in among the others, anybody is welcome to use it as his own.

In discussing the question of correcting the refraction except as incidental to the treatment of muscular anomalies, there is of course no intention to belittle this very important consideration in the

treatment of eye strain. Important as this branch of the subject undoubtedly is, correction of the refraction may be carried to the point of absurdity. When a patient with undoubted exophoria and insufficiency of the interni complains of severe headache, dizziness and nausea, excited or increased when convergence is attempted, it is perfectly silly to correct .12 or .25 D. of hypermetropia in such eyes, and yet many have done such things.

In studying the effect of correction of the refraction upon the ocular muscles, it is absolutely necessary to separate this secondary effect of glasses from the prismatic effect of a decentred lens. In order that the optical centre of a lens may be found, the lens should be held in front of a horizontal line in such a position that the line is continuous through the glass without deviation at either edge. The position of this line is then marked upon the glass and the process repeated at right angles to the first position; the lines cross at the optical centre and show in a sphero-cylindrical lens the axis of the cylinder and the maximum curve at right angles to it. In a simple cylinder the axis only can be found, as there is no prismatic displacement of a line at right angles to the axis; a cylinder with horizontal axis cannot be decentred horizontally, and similarly with the axis in other meridians. Two lines crossing at right angles may be used to find the optical centre

instead of the above-described method, or the lens may be held in front of an object, as a candle flame, in such a position that the reflected images from the surfaces of the glass are superimposed, when the position of the images shows the optical centre. The last method may be used for rapid verification under certain circumstances, but I prefer the first for several reasons. The base and apex of a prism are marked by a line continuous through the glass, just as the axis of a cylinder is. When the cylinder is revolved upon its centre, we notice a peculiarity of prismatic action due to the varying curves, which results in torsion of lines oblique to the axis, being most marked at an inclination of 45°. While there are causes for the distortion of objects caused by glasses other than simple prismatic effect, yet this prismatic action of the transparent cylinder has not only an important bearing upon the asthenopia produced by cylindrical lenses, but, taken in connection with other prismatic effects of curved surfaces and applied to the human eye with its frequently decentred astigmatic refractive media, it throws an entirely new light upon many observations in physiological optics and opens up a new field in the explanation of muscular anomalies. A very plausible connection could be shown between apparent divergence and convergence, the decentred biconvex lens system between the anterior corneal surface and

the posterior surface of the crystalline lens, and convergent and divergent squint; its bearing upon the subject in hand will be shown later.

The primary position of a pair of glasses in front of the eyes when it is desired to study their effects upon the ocular muscles is with the optical centres in the lines of fixation. This position can be obtained with considerable accuracy by sighting; that is, by making each examined eye fix the examiner's, when the optical centre of the glass is placed in the line which seems to correspond to the line of fixation of the former and the line of vision of the latter. If there is a question as to the correctness of this, discs with vertical stenopæic slits may be placed in an adjustable frame, and the distance between their centres measured when both eyes can see through the slits at the same time. This distance between the optical centres (o. c.) should not be confounded with the distance between the geometrical centres of glasses to be worn (p. d.), which should come opposite the pupils for the sake of appearance and because there will be less annoyance to the patient from the refraction and reflection at the edges of the lenses when they are symmetrical with the pupil.

The prismatic effect of a decentred spherical lens is obtained by multiplying the distance between the optical and geometrical centres, taken in centimetres and tenths, by the dioptric strength of the lens.