THE ACTION OF THE EXTERNAL MUSCLES OF THE EYE AND THE DIAGNOSIS OF OCULAR PARALYSIS

PROFESSOR ELSCHNIG'S DIAGRAM

BY

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THE ACTION OF THE EXTERNAL MUSCLES OF THE EYE, AND THE DIAGNOSIS OF OCULAR PARALYSIS: PROFESSOR ELSCHNIG'S DIAGRAM.

THE action of the individual orbital muscles and the effect of paralysis of one or more of them are admittedly not easy to keep in mind, especially by those who do not have to diagnose cases of strabismus every day. Even oculists find it convenient to employ a diagram, either real or mental, by which they may recognise from the character of the diplopia the particular muscle or muscles which are affected. So far as I am acquainted with the diagrams appearing in the text-books usually available to students and practitioners there is not one which is, in my opinion, so concise and so easily grasped as that of Professor Elschnig of Vienna. I have therefore ventured to epitomise the article in which he introduced it to his German-speaking *confrères* and which is published in the *Wiener klinische Wochenschrift* of August 28th, 1902. The same subject is dealt with by Professor Elschnig in the "Encyklopädie der Augenheilkunde," published by O. Schwarz. The diagram is a modification of one by Professor Schnabel, which has been much in vogue in Austria up to now.

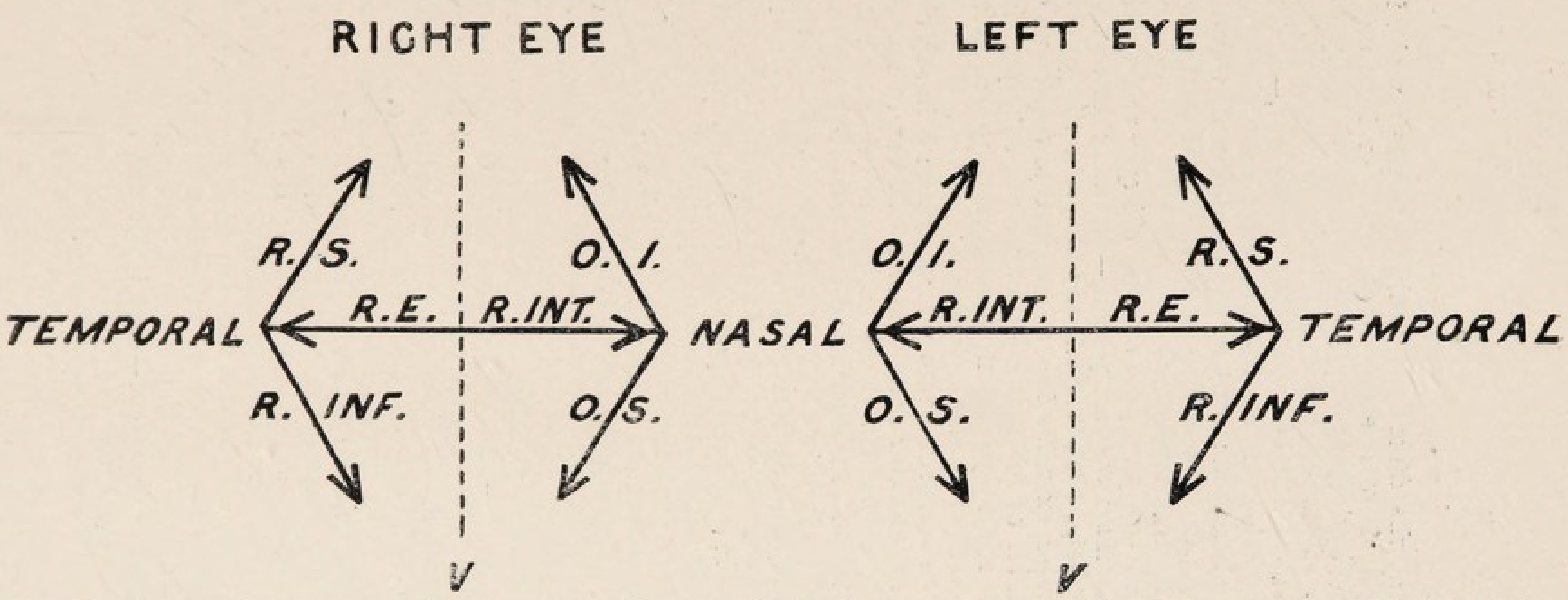
In the diagram each of the arrows representing the action of the individual elevators and depressors (rectus superior, obliquus inferior, obliquus superior, rectus inferior) indicates (*a*) the direction in which the summit of the cornea would be moved by isolated contraction of the muscle concerned, and (*b*) by the inclination of the arrows towards the vertical, the position imparted to the vertical meridian of the cornea, by the same contraction. For example, isolated contraction of the right superior rectus would: (*a*) move the summit of the cornea upwards and inwards, and (*b*) incline the vertical meridian of the cornea to the left (that is, "wheel-motion" to the left). ("In speaking of the inclination of the vertical meridian of the cornea it is the upper extremity of this meridian which is meant."—Swanzy.) Similarly, isolated contraction of the right inferior rectus would: (*a*) move the summit of the cornea downwards and inwards, and (*b*) incline the vertical meridian of the cornea to the right. The arrows on the horizontal line indicate the direction in which the summit of the cornea moves with isolated contraction of the external or internal rectus.

Further, the starting-point of each inclined arrow on this horizontal line indicates the position in which the cornea must be in order that isolated contraction of an elevator or depressor may have the greatest elevating or depressing effect. That is to say, the rectus superior and the rectus inferior (for example) exert the greatest effect as to elevation and depression of the cornea when the eye is in the abducted position; and the obliquus inferior and the obliquus superior exert their greatest effect as to elevation and depression when the eye is in the adducted position.

Also, since the "wheel-motion" action of the elevators and depressors in each case is in the inverse ratio to the elevating or depressing action—the greater the elevating or depressing action the slighter the "wheel-motion" action and *vice versâ*—there is evident from the diagram the position of the eye in which each elevator and depressor is able to exert the greatest "wheel-motion" action; that is, the rectus superior and rectus inferior exert the greatest "wheel-motion" action when the eye is in the adducted position and the obliquus superior and obliquus inferior exert their greatest "wheel-motion" action when the eye is in the abducted position.

The opposite of these two statements is true also—namely, that when the eye is adducted the elevating and depressing action of the elevators and depressors is least and when the eye is abducted the "wheel-motion" action of these muscles is least.

As a matter of fact, however, no regard needs to be paid to the "wheel-motion" in the diagnosis, by means of the diplopia, of paralysis, except in the case of the examination of the obliquus superior, the action of which muscle is best tested when the eye is adducted.



V. = Vertical meridian of cornea. R. Int. = Rectus internus. R. E. = Rectus externus. R. S. = Rectus superior. R. Inf. = Rectus inferior. O. S. = Obliquus superior. O. I. = Obliquus inferior.

A glance at the diagram therefore at once reveals, in the case of paralysis of one rectus (superior or inferior), that the defect of movement of the eye is most distinctly seen,—or, in other words, that the difference in height between the two images (false and true) is the greatest,—if the eye under examination be elevated or depressed while in the position of abduction; that is, for example, in the case of the right eye when it is turned to the right and upwards, or to the right and downwards.

In the case of paralysis of one oblique the defect of movement is most distinctly seen,—or, in other words, the difference in height between the two images is the greatest,—if the eye under examination be elevated or depressed while in the position of adduction—that is, for example, in the case of the right eye when it is turned to the left and upwards or to the left and downwards.

This may be translated into practice thus: if in any case of paralysis of an elevator or depressor the defect of movement of the eye (or the difference in height between the two images) is greater in the abducted position of the eye than in the adducted position one knows it is a rectus which is paralysed. In the opposite condition, where the defect of movement (or the difference in height between the two images) is greater in the adducted position of the eye than in the abducted, one knows that it is an obliquus which is paralysed.

A single example may still further elucidate the diagnosing of the paralysis from the examination of the double images by the use of this diagram. If the flame of the candle placed in the middle line reveals double images separated by distance in height, and if this distance in height increases the more the candle is lifted up one knows it is an elevator that is paralysed,—and an elevator of that eye, the image of which stands the higher (the image belonging to each eye is recognised, of course, by the aid of a coloured disc held before one of the eyes). Suppose, now, that this is the right eye. If, then, the elevated candle, always at the same height, be moved to the right and left, and if the distance in height between the two images increases as the candle is moved to the right (so that the eye tends to the abducted position) and diminishes as the candle is moved to the left (so that the eye tends to the adducted position), then we know that it is that elevator, the elevating action of which is the strongest in the abducted position, which is paralysed—that is, in this case the rectus superior of the right eye.

It is important in practice, when the elevators and depressors are being examined, to allow the patient to pay attention only to the distance in height between the images; the lateral interval, whether the diplopia be homonymous or crossed, is not only irrelevant but often perplexing and deceptive.

Further details of the diagnosis of the paralysis of the muscles of the eye by the use of this diagram are to be found in the article in the "Encyklopädie" already referred to.

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