ANNOTATION

PLEOPTICS

BY

T. KEITH LYLE

London

THIS word is intended to imply "special measures whereby full vision is developed" (Greek $\pi\lambda\acute{\epsilon}\sigma\varsigma$ = full, $\acute{\omega}\psi$ = sight). It has been known for many years that a constantly squinting eye tends to become amblyopic, and furthermore that the process involved is largely one of inhibition at a cortical level. It has also been observed that by means of occlusion of the fixing eye such amblyopia may be overcome—in some cases quite rapidly, in others only by prolonged occlusion, largely depending on the length of time during which a constant squint has been present.

For many years, however, ophthalmologists had been at a loss to explain how it was that, in certain cases of convergent squint in young children, in spite of a prolonged period of occlusion of the fixing eye, the visual acuity of the squinting eye failed to improve; as a "cloak" of ignorance, these were described as cases of "idiopathic amblyopia", "congenital amblyopia", or "intractable amblyopia". Some observers sought to explain them by postulating the existence of a small and ophthalmoscopically undetectable lesion in the foveal region (for instance, it was suggested that retinal haemorrhages caused by birth trauma might be an aetiological factor) but it was generally accepted that eccentric retinal fixation could develop in the absence of any such lesion, particularly when the squint occurred at an early age and when there was a prolonged interval between the onset of squint and the institution of effective treatment.

The extent of the problem was not appreciated because the diagnosis of eccentric fixation was then dependent on the recognition by simple observation that, during the fixation of a test object by the squinting eye (with the normally fixing eye occluded), the visual axis of the squinting eye was not directed towards the object. Small degrees of eccentric fixation were not detectable by such a method. More recently, however, the work of Bangerter (1953) and Cüppers (1956) has aroused a renewed interest in the problems of eccentric retinal fixation: its mode of development, its detection, its treatment and, perhaps most important of all, its prevention.

The retina, quite apart from its capacity of visual acuity, has a sense of spatial projection which is concerned with recognition of the correct localization of objects in space; the fovea bears the principal visual direction so that it is concerned with a "straight-ahead" projection to an object situated in the centre of the visual field. The development of an eccentric retinal fixation is associated with a loss of this function of the fovea, and an area of the retina other than the fovea becomes concerned with the reception of the image of the fixation object and assumes a foveal

type of visual direction. This differs from eccentric viewing, a condition in which an area of the retina other than the fovea is concerned with the reception of the image of the fixation object without any change in its visual direction so that there is the subjective awareness of "looking past" the object. Eccentric viewing occurs in structural lesions of the fovea.

It is suggested that eccentric retinal fixation is adopted by the squinting amblyopic eye in an attempt to obtain some form of "straight-ahead" vision, but this hypothesis is scarcely tenable because sometimes the suppressed fovea retains a better level of visual acuity than the eccentric area. It seems more likely, as suggested by Cüppers, that eccentric retinal fixation arises from the abnormal association of the two eyes; initially the abnormal retinal correspondence leads to a facultative change in the principal visual direction of the squinting eye which persists only while the two eyes are used together, but later in certain cases the change becomes obligatory and thereby forms an area of eccentric retinal fixation.

The detection of eccentric retinal fixation may be readily undertaken with the Visuscope, and this is an essential method of examination in all cases of squint in which there is any possible chance of an eccentric fixation, because it determines the correct form of occlusion to be used. If the fixation of the squinting eye is central then occlusion of the fixing, non-squinting eye (conventional occlusion) should lead to an improvement in the visual acuity of the squinting amblyopic eye, but if the fixation of the squinting eye is of a steady eccentric type such occlusion merely stabilizes the eccentric point, thus making it difficult, or even impossible, to restore central fixation subsequently; in these cases occlusion of the squinting eye (inverse occlusion) should be carried out for a prolonged period in an attempt to eliminate the abnormal form of fixation. There is, however, an intermediate group of cases in which the fixation, although tending to be eccentric, is unsteady, and it is justifiable in these cases to allow a short and carefully controlled period of conventional occlusion in the hope of restoring central fixation in the squinting eye.

The undesirability of allowing eccentric fixation to remain untreated is illustrated in those unfortunate adult patients in whom the loss of vision of the only good eye (by injury or disease) may cause considerable visual incapacity. These cases, however, are often the most rewarding to treat, since co-operation is invariably good.

The aim of treatment of eccentric fixation is two-fold: the restoration of correct central localization, and the restoration of normal visual acuity. The point "chosen" for fixation by the affected eye appears to be selected independently of its functional efficiency and the basis of eccentric fixation is a change in the space values of the retina—a change in local sign. Indeed, the principal visual direction which is normally physiologically linked with the fovea moves to the eccentric point and thus becomes the cardinal point of the sensory and motor co-ordination of the amblyopic eye.

The principle underlying Cüppers's method of treatment is the re-education of spatial projection by the use of entoptic phenomena such as after-images and Haidinger's brushes; these can be located in space as real objects and their projection may be governed or altered by the patient's own efforts. This treatment demands a high degree of concentration and co-operation on the part of the patient and is rarely applicable to children under the age of 6 or 7 years.

This does not imply that younger children are to be left untreated; a period of occlusion of the squinting eye (inverse occlusion) may disrupt the links relating the fovea of the fixing eye with the eccentric point of fixation of the squinting eye. This indeed has happened in many instances, but such treatment rarely results in restoration of central fixation if occlusion of the fixing eye (conventional occlusion) has already been carried out for any appreciable length of time, or if the eccentricity has become stabilized and fixed for several years. In cases in which the fixation although tending to be eccentric is unsteady, conventional occlusion may lead to central fixation, but repeated careful observations are required to ensure that eccentricity of fixation is not being encouraged. Indeed, it may be assumed that steady eccentric fixation takes some time to develop, so that if a child with a constant uniocular squint (whose eyes are free from organic disease) is treated early enough so that the squint is converted into a freely alternating one by means of judicious occlusion, the problem of eccentric fixation will be largely overcome. The newer methods of pleoptic treatment would not, however, lose their value, for the principles so magnificently worked out by the pioneers Cüppers and Bangerter may be of much value in the orthoptic treatment of abnormal retinal correspondence and other binocular anomalies.

Hence, as in so many medical and surgical problems, we are faced with the fact that the earlier the correct diagnosis is made and the correct treatment carried out the better the prognosis.

It must be emphasized, however, that the only certain way of diagnosing squint in early infancy is by means of careful routine examination. Squints of small degree—and none the less important—may easily be overlooked. Indeed, it often happens that the anomaly is unnoticed until a school inspection at the age of 5 or 6 years, when it is discovered for the first time that the visual acuity of one eye is grossly defective. In such cases, however, there is frequently a strong family history of "squint" or of defective vision of one eye. As Chavasse so aptly wrote in 1939: "The ophthalmological examination of every new-born child and the examination of the refraction of every infant, say at the age of 12 months, are reasonable counsels, but in the present state of medical and public opinion they are counsels of perfection only. On the other hand, the medical profession should and can advise the ophthalmological care of apparently normal infants born of squinting stock as well as the care of the apparently normal younger brothers and sisters of a child who has manifested a squint."

REFERENCES

- BANGERTER, A. (1953). "Amblyopie Behandlung". Karger, Basel.
 CHAVASSE, F. B. (1939). "Worth's Squint", 7th ed. Baillière, Tindall and Cox, London.
 CÜPPERS, C. (1956a). *Univ. Jena Math.-naturwiss. Reihe*, 5, 21.
 ——— (1956b). *Klin. Mbl. Augenheilk.*, 128, 345, 353, 379.