Adabtations to strabismus

Sensory adaptations to strabismus

The ocular sensory system in children has the ability to adapt to anomalous states (confusion and diplopia) by two mechanisms: suppression and abnormal retinal correspondence (ARC). These occur because of the plasticity of the developing visual system in children under the age of 6–8 years. Occasional adults who develop sudden-onset strabismus are able to ignore the second image after a time and therefore do not complain of diplopia.

- Suppression involves active inhibition by the visual cortex of the image from one eye when both eyes are open. Stimuli for suppression include diplopia, confusion and a blurred image from one eye resulting from astigmatism/anisometropia. Clinically, suppression may be:
  - *Central* or *peripheral*. In central suppression the image from the fovea of the deviating eye is inhibited to avoid confusion. Diplopia, on the other hand, is eradicated by the process of peripheral suppression, in which the image from the peripheral retina of the deviating eye is inhibited.
  - *Monocular* or *alternating*. Suppression is monocular when the image from the dominant eye always predominates over the image from the deviating (or more ametropic) eye, so that the image from the latter is constantly suppressed. This type of suppression leads to amblyopia. When suppression alternates (switches from one eye to the other), amblyopia is less likely to develop.
  - *Facultative* or *obligatory*. Facultative suppression occurs only when the eyes are misaligned. Obligatory suppression is present at all times, irrespective of whether the eyes are deviated or straight. Examples of facultative suppression include intermittent exotropia and Duane syndrome.
- Abnormal (anomalous) retinal correspondence (ARC) is a condition in which non-corresponding retinal elements acquire a common subjective visual direction, i.e. fusion occurs in the presence of a small angle manifest squint; the fovea of the fixating eye is paired with a non-foveal element of the deviated eye. Binocular responses in ARC are never as good as in normal bifoveal BSV. It represents a positive sensory adaptation to strabismus (as opposed to negative adaptation by suppression), which allows some anomalous binocular vision in the presence of a heterotropia. It is most frequently encountered in small angle esotropia (microtropia), but is less common in accommodative esotropia because of the variability of the angle of deviation and in large angle deviations because the separation of the images is too great.
- Microtropia is discussed before

- **Consequences of strabismus**

○ The fovea of the squinting eye is suppressed to avoid confusion.
○ Diplopia will occur, since corresponding retinal elements receive different images.
○ To avoid diplopia, the patient will develop either peripheral suppression of the squinting eye or ARC.
○ If constant unilateral suppression occurs this will subsequently lead to strabismic amblyopia.

Motor adaptation to strabismus

Motor adaptation involves the adoption of a compensatory head posture (CHP) and occurs primarily in children with congenitally abnormal eye movements who use the CHP to maintain BSV. In these children loss of a CHP may indicate loss of binocular function and the need for surgical intervention. These patients may present in adult life with symptoms of decompensation, often unaware of their CHP. Acquired paretic strabismus in adults may be consciously controlled by a CHP provided the deviation is neither too large nor too variable with gaze (incomitance). The CHP eliminates diplopia and helps to centralize the binocular visual field. The patient will turn the head into the direction of the field of action of the weak muscle, so that the eyes are then automatically turned the opposite direction and as far as possible away from its field of action (i.e. the head will turn where the eye cannot).

• **A face turn** will be adopted to control a purely horizontal deviation. For example, if the left lateral rectus is paralysed, diplopia will occur in left gaze. The face will be turned to the left, which deviates the eyes to the right, away from the field of action of the weak muscle and area of diplopia. A face turn may also be adopted in a paresis of a vertically acting muscle to avoid the side where the vertical deviation is greatest (e.g. in a right superior oblique weakness the face is turned to the left).

• **A head tilt** is adopted to compensate for torsional and/ or vertical diplopia. In a right superior oblique weakness, the right eye is relatively elevated and the head is tilted to the left towards the hypotropic eye. This reduces the vertical separation of the diplopic images and permits fusion to be regained. If there is a significant torsional component preventing fusion, tilting the head in the same left direction will reduce this by invoking the righting reflexes (placing the extorted right eye in a position that requires extorsion).

• **Chin elevation or depression** may be used to compensate for weakness of an elevator or depressor muscle or to minimize the horizontal deviation when an ‘A’ or ‘V’ pattern is present.