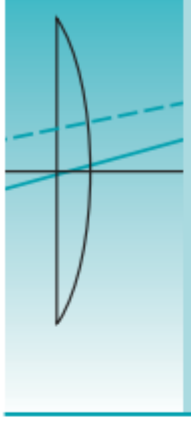


6 MANAGEMENT OF HETEROPHORIA: BASIC PRINCIPLES

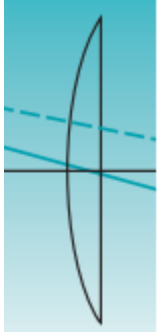
Before dealing with the individual heterophoric conditions in Chapters 7–9, this chapter outlines the basic principles of management. There are two reasons to treat a heterophoria: first to alleviate symptoms and second to prevent the heterophoria from breaking down into a strabismus. It is easier to treat a heterophoria than a strabismus and if a heterophoria is allowed to break down into a strabismus this can lead to serious problems such as diplopia and amblyopia.

Following the investigation of binocular vision and the total findings to reach a diagnosis, a decision must be made regarding the best course of action to assist the patient: the management of the case. In general, there are five possible lines of action that may help in alleviating symptoms. Normally, they would be considered in the following order:

(1) Remove the cause of decompensation
(2) Refractive correction
(3) Give eye exercises
(4) Prescribe prism relief
(5) Refer to another practitioner.

Although it is logical to consider them in this order, it may be that some are not appropriate or possible in a particular case. Sometimes one course of action is going to constitute the primary or sole treatment of the case. For example, in many cases of decompensated heterophoria, the refractive correction by itself will result in the phoria becoming compensated and no further action will be necessary. In other cases, where there is the possibility of active disease or pathology, or of recent injury, referral will be the first priority and other possibilities may not be pursued until appropriate medical attention has been given.

In the healthcare sciences there are several levels of the type of evidence that may be produced in support of an intervention or treatment (Evans 1997a). The initial evidence is often in the form of anecdotal clinical observations. These may be supported by open trials (e.g. Dalziel 1981) but both these types of evidence are influenced by the placebo effect. The placebo effect should not be underestimated (Evans 1997b) and a therapy can only



be convincingly proved by double-masked placebo-controlled trials. Unfortunately, there have been very few attempts to apply this type of research to the treatments for heterophoria (Ciuffreda & Tannen 1995, pp 124–144). Even a strong theoretical justification for a treatment does not completely replace the need for double-masked placebo-controlled trials. Theoretical justification, together with open trials and anecdotal clinical observations by many practitioners, may provide overwhelming circumstantial evidence for many of the therapies that are described in this chapter, but it is unfortunate that many of the therapies have not been subjected to double-masked placebo-controlled trials.

Removal of cause of decompensation

Consideration must be given to those general factors that put stress on the visual system or on the general wellbeing of the patient. These factors are discussed in Chapter 4. It will be obvious that all five lines of action outlined on page 99 will aim at removing the cause of the decompensation, and therefore the other four options may also contribute to this. However, there are some factors that contribute to binocular anomalies that do not come under the other headings. For example, a patient working long hours at excessively close work in poor illumination will need to give consideration to proper working conditions and will be advised accordingly. In some cases, improving the visual working environment will be all that is required to restore compensation of the heterophoria.

Immediate removal of some of these general factors of decompensation may not be possible, as in some instances of poor general health, in old age, or in some vocations. Greater reliance must then be placed on the other options.

Refractive correction

The importance of the refractive correction has already been discussed in the section on refraction and visual acuity in Chapter 4. In many cases, decompensated heterophoria and binocular instability become compensated when a refractive correction is given. It may improve binocular vision for one or more of the following reasons:

(1) Accommodation–convergence relationship

Uncorrected spherical error may result in an abnormal degree of accommodation. This will be excessive in hypermetropia and, for near vision, it will be less than normal in myopia. Because of the link of accommodation to convergence, this can result in stress on convergence.

The general rule is that, if significant esophoria is found, the practitioner should search carefully for hypermetropia. Significant esophoria in a young patient is an indication for cycloplegia (see Box 2.1). Some cases will require multifocal lenses and these types of case are discussed further in Chapter 7.

For esophoria with myopia, a myopic correction is required to give clear distance vision but care must be taken not to give an overcorrection; an undercorrection of 0.50 D may be tolerated.

In cases of decompensated exophoria and myopia, an overcorrection can be considered if the patient's amplitude of accommodation is adequate. The patient should be given the minimum overcorrection ('negative add') for the exophoria to become compensated. The negative add is then gradually reduced over a period of months so that the patient's fusional reserves increasingly compensate for more of the deviation. For exophoric patients with hypermetropia, care must be taken that the correction does not contribute to the phoria becoming decompensated; a partial correction can be considered if this is likely.

(2) Blurring

If it occurs in one or both eyes, blurring will make binocular vision more difficult. This is particularly important in high astigmatism, and care must be taken to ensure an accurate astigmatic correction. Dwyer & Wick (1995) suggested that the correction of even small refractive errors can dramatically improve binocular function, although other research suggests that this may be unlikely (Ukwade & Bedell 1993). Dwyer & Wick (1995) argued that, even in low hypermetropia, spectacles might eliminate slight blur and aid the compensation of phorias. It would be interesting for placebo-controlled trials to investigate this hypothesis.

(3) Anisometropia

Anisometropia produces interocular differences in blurring. It can be important in making the heterophoria decompensated and in causing binocular instability. In some cases, the differences in the refractive error between the two eyes is gross and this needs particular attention (Ch. 11). In other cases, care must be taken to ensure that the refractive correction is properly balanced, either by a retinoscopic method or subjectively. The methods are described in Chapter 4.

Conditions amenable to treatment through refractive modification

It can be seen from the section above on the accommodation–convergence relationship that, even for an emmetropic patient, a refractive correction can be used to correct a decompensated heterophoria. The principle is to over-minus or under-plus ('negative add') the patient in exophoria and to over-plus or under-minus ('positive add') the patient in esophoria. This form of treatment is sometimes described as refractive modification and the conditions that can be treated in this way are summarized in Table 6.1 and in Chapters 7 and 8.

For refractive modification with negative lenses to work, the patient must have adequate accommodation and a higher AC/A ratio will make refractive modification more likely to succeed. The only conditions that are not amenable to treatment by refractive modification are cases of esophoria

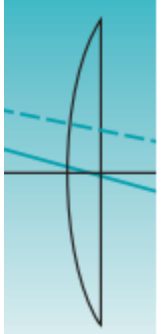


Table 6.1 Summary of refractive modification as a treatment for decompensated heterophoria

Condition	*Modification to refractive correction*
Basic esophoria (problematic esophoria at distance and near)	Maximum plus; bifocals may help at near
Divergence weakness esophoria (problematic esophoria at distance)	Maximum plus at distance
Convergence excess esophoria (problematic esophoria at near)	Bifocals or varifocals
Basic exophoria (problematic exophoria at distance and near)	Over-minus at distance and near
Divergence excess exophoria (problematic exophoria at distance)	Over-minus at distance, perhaps bifocals
Convergence weakness exophoria (problematic exophoria at near)	Upside-down executive bifocals (p 121)

that are producing symptoms at distance vision. This is because, in the absence of latent hypermetropia, there is clearly a limit to how much over-plussing a patient can tolerate before the blur produces symptoms.

Clinical approach to treatment through refractive modification

The clinical technique for this approach is very simple. In most cases, the spherical correction that eliminates any fixation disparity on the Mallett unit at the relevant distance(s) is determined. The result should be confirmed with a cover test, where a rapid and smooth recovery indicates that the refractive modification is adequate. As a general rule, the required correction is the smallest that will eliminate a slip on the Mallett unit and give good cover test recovery (bearing in mind the effects of tiredness).

If bifocals are used with children, then the segment should be fitted high, aiming to bisect the pupil. Regular adjustment of the spectacles is necessary since, if they start to slip down the nose, the bifocal add may become ineffective. An initial follow-up appointment as soon as a month after the spectacles are prescribed may be advisable.

Patients with abnormal binocular vision (Schor & Horner 1989) and symptoms (Fisher et al 1987) often do not show the usual adaptation to prisms or refractive corrections and this may explain why they have a binocular vision anomaly. If a patient does not seem to be responding to treatment by refractive modification then before increasing the sphere further it is a sensible precaution to leave the patient with the correction in place for about 2–3 min to ensure that its effectiveness is maintained (North & Henson 1985). Some

practitioners may be concerned that 'negative adds' might lead to myopia but Grosvenor et al (1987) found no convincing evidence that refractive modification influences refractive development over the age of 2 years.

Spectacles designed to treat orthoptic problems by refractive modifications are often described as 'exercise glasses' and this is a useful metaphor. The goal should be to reduce the strength of the overcorrection, perhaps every 3 or 6 months. It is as if the patient's fusional reserves are being very slowly built up by gradually reducing the strength of the overcorrection that is required. At each appointment the usual tests of compensation (Ch. 4) are repeated with the proposed new refractive correction, and the minimum refractive modification to render the heterophoria compensated is prescribed. Jennings (2001a) advocated a 'courageous approach to reduction' of the refractive modification at follow-up appointments.

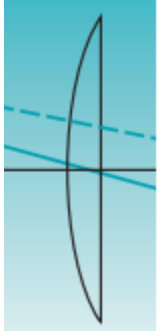
In intermittent exotropia, minus lens therapy improved the quality of fusion in 46% of cases (Caltrider & Jampolsky 1983). These authors cautioned that cases with high AC/A ratios could develop an esotropia, which required discontinuation of this treatment; and therefore recommended the first check 3–4 weeks after prescribing. The duration of treatment ranged from 2 months to 13 years with a median of 18 months. They concluded: 'We have been impressed by the long-term success in control of the exodeviation after removal of the minus lenses'.

Effect of multifocal lenses on myopia development in children

It is sometimes argued that prescribing young myopic or premyopic patients with multifocal lenses or low plus reading glasses might reduce the rate of myopic progression (Press 2000). However, research shows that multifocals are not generally effective at controlling myopia (Grosvenor et al 1987, Grosvenor 1998). The exception to this is for a small subgroup of myopes who are esophoric at near (Grosvenor 1998). For this subgroup, bifocals can reduce the rate of progression of myopia by about 20% according to a randomized trial that used a +1.50 add (Fulk et al 2000a). It has been argued that individually prescribed additions may be more effective (Press 2000), although there is no universal agreement regarding what criteria should be used to prescribe an addition (Fulk et al 2000b). A possible mechanism for the benefit from multifocals has been discussed by several authors (Goss & Rosenfield 1998, Gwiazda et al 1999, Rosenfield & Gilmartin 1999).

Eye exercises

Usually, the effect of the correction of any significant refractive errors on the heterophoria is assessed before eye exercises (orthoptics) are considered. The patient is asked to wear any significant refractive correction for about 1 month to see if this will alleviate the symptoms. In those cases where there is a negligible refractive error, eye exercises may be considered immediately.



In general, decompensated heterophoria responds well to eye exercises, although the response varies from one case to another. Suitable exercises are discussed in Chapter 10. Particular types of heterophoria are discussed in the next five chapters, which indicate the conditions likely to respond to exercises. In brief, exophoria responds best to exercises and hyperphoria is least likely to respond.

Although some authors argue that eye exercises are harder for older patients (Winn et al 1994), one study showed that they can be effective, although further follow-up exercises are quite often necessary (Wick 1977). Exercises are probably most successful over the age of 10 years but can be effective for younger patients if the exercises are understood. Patients under 12 years present less frequently with decompensated heterophoria.

Another factor influencing the success of eye exercises is the motivation of the patient. Sometimes the patient is not prepared to give the necessary time and effort. Where the symptoms are marked, the incentive will usually be high. In conditions where suppression has intervened to lessen the symptoms, the disturbance to binocular vision may be marked but there may be less incentive for the patient to carry out the exercises. Teenage patients may have a great deal of school work and a broad range of other interests competing for their time. Some patients will readily undertake the exercises and will conscientiously carry them out to the end. Others will start enthusiastically but prove to have insufficient patience to complete the course. The practitioner's enthusiasm, however, may prove infectious and regular follow-up appointments can help to encourage compliance.

It is important to understand the nature of eye exercises. Orthoptics is a learning process, in the same way as other motor skills are learned. There are many motor skills that we may require during life. They vary from such things as learning to ride a bicycle to touch-typing. They require practice until the motor and sensory systems are coordinated to undertake them automatically (automaticity). At first, a good deal of thought and concentration is required but in time they become 'conditioned reflexes'. Orthoptics consists of re-educating the visual reflexes and acquiring proper visual habits. Eye exercises are not concerned with strengthening the power of the individual eye muscles but with re-establishing correct muscle and sensory coordination. The accuracy of vergence and accommodation is increased when observers are asked to 'concentrate' rather than to 'space-out' (Francis et al 2003). Whether this is a part of the mechanism of eye exercises remains to be seen. Both the fast and slow vergence mechanisms seem to be improved by eye exercises for convergence insufficiency (Brautaset & Jennings 2006b).

The conventional view that exercises increase the fusional reserves without affecting the size of the heterophoria has been questioned (Jennings 2001a). This is because research on prism adaptation suggests that exercises may also reduce the heterophoria by enhancing the ability to adapt to prisms (North & Henson 1982). This view is supported by research that showed that convergent fusional reserve exercises not only increased convergent fusional reserves but also significantly reduced exophoria (Evans 2000a).

Early evidence suggested that eye exercises for decompensated exophoria might increase the AC/A ratio, although the effect regressed within a year (Flom 1960). A recent study found no change in AC/A ratio after eye exercises for convergence insufficiency (Brautaset & Jennings 2006b).

The patient must have sufficient intelligence to understand what is required, and the exercises be explained simply enough to be understood. The patient does not necessarily need to understand the exact nature of the binocular anomaly but only what he or she is required to do. However, it usually helps in maintaining interest and cooperation if the broad aims of the particular treatment can be explained.

The exact type of eye exercises that may be given will vary with the particular type of heterophoria present, and this is discussed with the various types of heterophoria in Chapters 7–9. Specific types of exercises are discussed in detail in Chapter 10.

The literature on the efficacy of fusional reserve exercises was reviewed by Evans (2001b) and is discussed in more detail in Chapter 10. This chapter also discusses the different types of exercises and the features of exercises that are likely to improve their efficacy. A general rule is that intensive exercises for 2–3 weeks are much more likely to be successful than months of infrequent exercises (Evans 2001b, Jennings 2001a).

Prism relief

Where eye exercises are inappropriate because of age or ill-health, or because of lack of time or incentive on the part of the patient, prism relief may be considered. As mentioned above, some heterophoric conditions are unlikely to respond to orthoptics, and relieving prisms are more appropriate. Hyperphoria is of this type. Therefore, in decompensated hyperphoria prism relief is more usual.

The power of the prism to be prescribed is the minimum that just allows the heterophoria to become compensated, sometimes described as the uncompensated portion of the heterophoria. This is invariably less than the degree of the phoria measured by a dissociation method. It is more likely to be the degree of the aligning prism (Lyons 1966). Indeed, the Mallett unit is designed to give an adequate fusional lock, so that the weakest prism that neutralizes the fixation disparity is the appropriate prism to incorporate in the prescription (Mallett 1966). A small, double-masked randomized controlled trial showed that prisms prescribed with the Mallett unit were consistently preferred by patients to spectacles without prism (Payne et al 1974).

The prism power can also be assessed by finding the weakest prism that produces a quick and smooth recovery movement to the cover test. Indeed, any of the clinical tests described in Chapter 4 for assessing compensation may help in prescribing prisms, although one trial suggests that prisms based on Sheard's criterion are not likely to be effective (Scheiman et al 2005a).

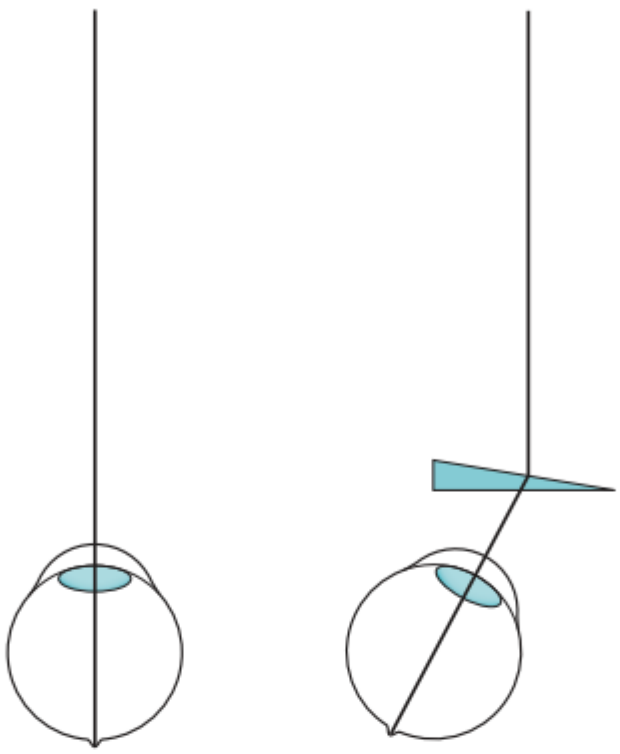


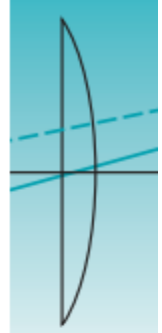
Figure 6.1 Diagram illustrating the required prism direction. In the example, the patient has an exophoria so relief for the heterophoria is provided using a prism (base-in) that allows the eyes to adopt a more divergent position.

The prism direction that is required allows the eyes to adopt a position that reflects the type of heterophoria (Fig. 6.1). This is an important point: the prism is not a treatment but provides relief (Appendix 1).

Prism adaptation

Adaptation to prisms occurs in most patients with normal binocular vision. When the prism is first placed before the eyes, it will relieve the heterophoria by the magnitude of the prism and also lessen the fixation disparity. After 2–3 min (Henson & North 1980), the binocular system adapts to the prism, and the heterophoria and the fixation disparity return to the original value (Carter 1963, 1965). Prism or vergence adaptation is likely to be a natural mechanism to keep the visual axes comfortably aligned. Vergence adaptation probably accounts for the finding that heterophoria is not normally distributed (Rosenfield 1997): more people are orthophoric than would be expected to occur by chance ('orthophorization'; Dowley 1987, 1990). Heterophoria probably occurs because of a partial saturation of prism adaptation (Dowley 1990) and prism adaptation is inversely related to fixation disparity (Schor 1979).

It appears that most patients with abnormal (symptomatic) binocular vision have poor vergence adaptation (North & Henson 1981) and poor accommodative adaptation (Schor & Horner 1989). The abnormal vergence adaptation was found in a group of patients with convergence insufficiency and also affects the patients' horizontal vergence (convergence and divergence) at other distances (Brautaset & Jennings 2005a) but not



the vertical vergence (Brautaset & Jennings 2005b). It has also been shown that some patients who had abnormal adaptation to prisms before receiving eye exercises have normal prism adaptation after treatment (North & Henson 1982, 1992). Prism adaptation decreases linearly with age and this may be why older patients tend to do slightly less well with orthoptic exercises but often respond well to the prescribing of prisms (Winn et al 1994).

Carter felt that practitioners should only be wary where there are repeated increases in prism (Carter 1963). In such cases then before increasing the prism further it is a sensible precaution to briefly try the proposed new prism in a *pre-prescribing prism adaptation test*. This term has been used to differentiate this brief test from the more prolonged pre-surgical prism adaptation test (p 320). Research suggests that patients who adapt will show significant signs of this after as little as 2 min (North & Henson 1981, 1982), although some authors have recommended longer (Rosenfield et al 1997). The deviation should then be reassessed to check that adaptation has not occurred (Rosenfield 1997). If most or all of the original deviation has returned, the prismatic correction is unlikely to be successful and another mode of treatment should be used. This test is not usually necessary but might be useful in a case where the practitioner is considering prescribing prisms but the patient reports that these have not helped in the past.

Referral

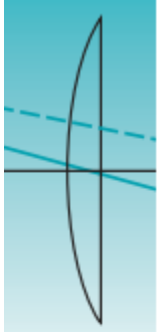
Under some circumstances, a patient must be referred or a report sent to another practitioner. It is important to be guided in this decision not only by the law or local regulations, which may require referral, but also by what is in the best interests of each patient. Patients should be referred if:

(1) there is a factor contributing to the decompensation of the heterophoria or binocular instability that requires attention by another practitioner; for example, the patient's health may have deteriorated, causing the decompensation
(2) the cause of the binocular anomaly is suspected to be pathological or a recent head injury
(3) the binocular anomaly is unlikely to respond, or has not responded, to any of the approaches described in this chapter.

All practitioners need to appreciate the limitations to their own field of expertise, experience and competence, and to refer appropriately is in their own interest as well as that of the patient.

Summary

The management of heterophoria consists of identifying the factors contributing to the decompensation and removing as many of these as possible.



In many cases the correction of the refractive error will achieve this end. Sometimes it is necessary to improve binocular functions by refractive modification, eye exercises or prism relief. If the patient is suffering from more general stress or poor health, referral to an appropriate practitioner may be required.

In general, symptoms due to heterophoria can be said to be the result of some change in the patient's circumstances that has contributed to stress on the binocular vision, e.g. additional close work or poor health. This change is likely to be fairly recent: long-standing problems either have developed suppression of one eye to alleviate the symptoms or the patient will have been well aware of the problem over a long time. Recent changes in the patient's circumstances are more easy to identify and, once identified, the heterophoria can be managed by one of the five lines of action described in this chapter.

Clinical Key Points

- At every visit look for active pathology
- Don't underestimate the effect of refractive errors: clear retinal images aid fusion
- Removing the cause of decompensation, including refractive corrections and changes to the workplace, often eliminates the need for treatment
- Don't forget the usefulness of modifying the refractive correction as a treatment
- Exo-deviations are easiest to treat with eye exercises: hyper-deviations are hardest