



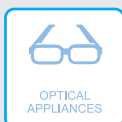
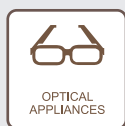
COMPETENCIES COVERED

DISPENSING OPTICIANS

Communication, Optical Appliances, Refractive Management, Paediatric Dispensing

OPTOMETRISTS

Communication, Optical Appliances, Binocular Vision



This CET has been approved for 1 point by the GOC. It is open to all FBDO members, and associate member optometrists. The multiple-choice questions (MCQs) for this month's CET are available **online only**, to comply with the GOC's Good Practice Guidance for this type of CET. Insert your answers to the six MCQs online at www.abdo.org.uk. After member login, go into the secure membership portal and CET Online will be found on the L menu. **Questions will be presented in random order.** Please ensure that your email address and GOC number are up-to-date. The pass mark is 60 per cent. The answers will appear in the August 2020 issue of Dispensing Optics. The closing date is 10 July 2020.



C-74548 Approved for 1 CET Point

Dispensing and binocular vision anomalies

By Ben Marchant BSc (Hons) Orth FBDO

Binocular anomalies and their diagnosis and management are core competencies for both optometrists and dispensing opticians through initial education, examinations and continued education. Despite this, it remains to be considered a dark art, with some optometrists rarely daring to change what was prescribed before them, even when finding contraindicating results themselves. And it's hardly surprising when students are expected to understand the intricacies of a jam-packed three-year degree in a few lectures, course work modules and placements.

In practice, orthoptic anomalies will be seen all the time, and often their symptoms are hidden or misinterpreted because they are perceived by the patient and practitioner as more common asthenopic symptoms like blur or strain. Diplopia isn't always a large deviation; it could be a very slight overlap which is perceived by the patient as a blurred image.

Orthoptic patients can be hard to detect so special considerations might not be made when dispensing. Many orthoptic patients may come back after your practice made an initial referral and then return to have specs made up. Others may come for the first time with the only 'history' written on a hospital prescription form leaving no indication of the binocular aspect of their investigations and treatment. Others are much more easily identified as they are symptomatic of diplopia or have had a prism prescribed.

HOSPITAL REFRACTIONS

The majority of paediatric hospital eye service (HES) prescriptions seen in

practice will have an orthoptic management plan or investigation. Be it for potential amblyopia or strabismus, if they are under the HES it's for a reason. When prescribing a child with their first prescription, a confirmed diagnosis is not possible to obtain, and questions may still remain such as how will the strabismus react to the introduction of spectacle correction and what will the visual acuity (VA) be after full refractive adaptation.

Without these two, a confirmed diagnosis for strabismus or confirming amblyopia is not possible so a diagnosis is only tentative. However, is that tentative diagnosis on the prescription or on subsequent hospital prescriptions once diagnosis is confirmed? Rarely. Lack of communication is the hardest part of doing the best dispense for that patient.

The usual features of an HES prescription are:

- No recorded visions or VA
- No vertex distance
- A sudden increase in prescription without explanation
- E-line bifocal requested
- No diagnosis to work from

There is usually a perfectly good explanation for these missing pieces of information. Recording visions of a child with amblyopia can be very difficult. At the age of onset, they can be very shy anyway, but when their good eye is covered, all their attention goes from the test to removing any occlusion.

The vast majority of paediatric refractions in the HES are carried out under cycloplegia. Trial lenses are often held by hand while cycloplegic retinoscopy is performed, meaning that a measurement for vertex distance cannot be accurately obtained if attempted at all.

The trial lenses are held as close to the patient's eye as possible, so spectacles which are fitted as closely as possible will best meet the same testing parameters.

STEP PRESCRIPTIONS

A sudden increase in prescription is usually due to the fact the full refractive error was not prescribed at the previous/initial appointment. A young child with a large degree of uncorrected hypermetropia will be able to accommodate a huge amount in comparison to even an older child, and can achieve remarkable uncorrected VAs. Their binocular status is very likely to be compromised in this achievement but nevertheless they can see well.

Often in cases of an accommodative strabismus the cycloplegic refraction is found to be approximately +6.00DS to +8.00DS. If when uncorrected the child is already accommodating by a similar amount and the full prescription is ordered, they are very likely to reject the spectacles and cause a delay in treatment. A step prescription is therefore ordered knowing that it will neither fully correct the strabismus or give optimum VA – but it will relax the child's accommodation enough to then order the full correction within a few months.

DISPENSING IN STRABISMUS

An E-line bifocal request can be attributed to orthoptic treatment text books: students are told that in childhood cases where bifocals are needed to use an E-line bifocal, because at the time those textbooks were written this was the best option to achieve a wide field of near vision and no-jump effect. Orthoptists are not taught any ophthalmic lens availability so this request remains gospel. In reality, a D40 bifocal will achieve the same results when considering the segment size and the child's likely frame box measurements. The use of D35 segments would also be a suitable compromise in those without a large degree of power in the main lens such as those with convergence excess esotropia.

Good communication and a professional relationship with our hospital colleagues could be the difference between good and outstanding care for these patients. If they knew reasons why certain information was necessary to a dispensing optician, they would both continue their own professional development and

improve their own patient care when outsourcing their spectacles, by adding any relevant information which could influence the dispense.

When considering potential issues during the dispensing of a patient with strabismus, it's important to remember a strabismus falls under one of two subcategories: concomitant and incomitant.

CONCOMITANT DEVIATIONS

Concomitant strabismus is predominantly horizontal; ocular movement is normal for the age of the patient and the angle of deviation is virtually the same in either eye when used for fixation¹. More simply put, it's because a muscle system is too strong rather than one particular muscle or nerve no longer functioning properly.

Many convergent concomitant deviations have an accommodative element. When accommodating, there is also convergence in order to see clearly and maintain binocularly for near. The two actions are linked involuntarily. When uncorrected hypermetropia is present, this ability to accommodate can be used to see clearly, however, as the convergence response is involuntarily linked to accommodation, a convergent eye movement is also made. This may be present as an esophoria (only observable through a cover test and controlled due to fusional reserves) through to a moderate esotropia (noticeable just on observation of the patient).

One way to eliminate or reduce the potential convergent movement upon accommodation is to have the patient

fixate on a light target when measuring centration distances (CDs) rather than on an accommodative target such as a pen.

Smaller manifest deviations, or ones which decompensate (going from 'phoria to 'tropia due to fatigue), can be difficult to notice, meaning that the CDs might be ordered with unwanted inward decentration. Consider an accommodative esotropic patient whose CDs have been incorrectly over-decentred inwardly. This will result in unwanted prism, which may result in a lack of binocular single vision (BSV) being achieved. Depending on the age of the patient, this then could lead to binocular features such as stereopsis not being developed during their critical period, something which cannot be achieved later in life.

SUPPRESSION AND AMBLYOPIA

As the vast majority of concomitant deviations are present from childhood, a suppression area may develop so the patient does not experience diplopia when the light falls on an uncorresponding retinal point. This suppression is what causes strabismic amblyopia, as the image is ignored leading to a lack of visual development in the affected eye's visual cortex. From a dispensing point of view, this patient's spectacles could be incorrectly centred and they may go from experiencing BSV to suppressing the eye.

Imagine this by closing one eye. You would go from having a full field of view, with depth perception, to no longer having it. Younger patients would not appreciate this but older patients who

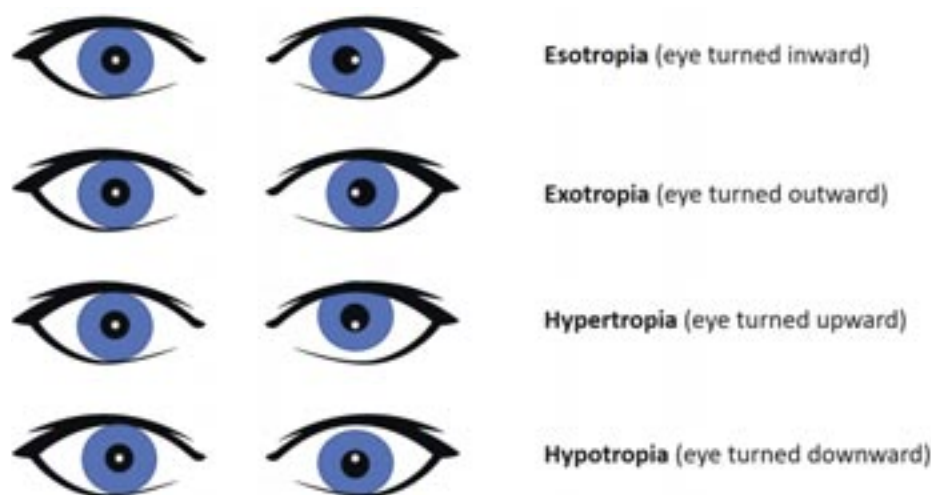


Figure 1. The Hirschberg test. Observing corneal reflexes
(source: Moran Core, University of Utah under the Creative Commons Attribution-NonCommercial-No Derivatives 4.0 International License)

have had normal BSV development, and still have the ability to suppress when not corrected, would experience a loss of binocularity without diplopia. How would a patient explain this? A common complaint is: "They just don't feel right, I can't explain it".

When dispensing to any pre-presbyopic patient who is hypermetropic, it's worth measuring CDs monocularly, due to the linked convergence response, in order to eliminate this risk. Detecting a small angled strabismus in someone who suppresses it can be difficult. Esotropias are the hardest to detect by observation alone. If you suspect someone may have a suppressed manifest deviation try observing their corneal reflections.

Using a pen torch, observe the position of the reflections (**Figure 1**). For the fixing eye, the corneal reflection is seen most commonly slightly inset (nasal) of the centre of the pupil. If the other eye's reflection is grossly similar in position, it's fair to assume no manifest strabismus is present when observing the light (a non-accommodative target). If the reflection is observed in an asymmetrical position, monocular CDs should be measured.

The gold standard in detection of either latent 'phorias or manifest 'tropias would be to perform a cover test and observe the movement seen. The cover/uncover technique should be applied to observe manifest/heterotropia movement and alternative cover test will show any latent/heterophoria element. A wide rule would act as a perfectly good occluder for this test with a pen as the target.

There are a wide variety of great online tools to demonstrate cover test techniques and findings. The author suggests visiting the American Academy of Ophthalmology's website for their strabismus simulator². Here, an angle of deviation can be input and the simulator will show what would be observed both with the cover/uncover and alternate cover test, as well as what effects of prism introduction upon the angle and movement would be seen. Additionally, there are some really helpful YouTube videos which would help with technique and interpretation of the results^{3,4}.

If a patient with a concomitant deviation experiences diplopia, it is usually because they once had adequate control of the condition through



Figure 2. The nine positions of gaze (courtesy of Medscape <https://emedicine.medscape.com/article/1189759-overview>)

excessive fusional reserves and have subsequently lost such ability through age, overexertion or other environmental or chemical factor such as medication use. Suppression does not assist them as they did not develop it during the critical period, so prism correction is required to achieve BSV. The deviation may measure much more in prism dioptres than is ordered, and this is because the patient will have some ability to realign the eyes themselves and the prism is just assistance to do so with comfort and ease throughout the day.

Generally, in relation to dispensing issues, concomitant deviations do not significantly differ in prism strength when the eyes move into different positions of gaze. As for horizontal control, the fusional reserve is much larger, meaning any difference in the size of deviation when moving eyes into differing positions is still controlled by the same prism strength as ordered for viewing in primary position.

INCOMITANT DEVIATIONS

Incomitant deviations are vertical, horizontal or torsional (rotary) and are caused most commonly by a cranial nerve palsy or ocular muscle abnormality, including restrictive strabismus due to congenital anomalies or trauma¹. They can be congenital but are more often acquired.

The characteristic of incomitant deviations which poses the biggest

implication for dispensing is that the angle of deviation increases as the eyes are turned in the direction of the affected muscle/cause of limited movement. Likewise, the angle of deviation decreases when the eyes are moved in the opposite direction. The exception to this would be nerve palsies, which are caused by trauma affecting both sides¹ but these are less likely to be seen in practice.

This has huge implications for correcting with prism, being able to detect that someone has an incomitant strabismus and also for explaining to a patient what the limitations will be with their spectacles. This will help considerably with their adaptation and tolerance based on expectations. If the patient has an incomitant deviation, the prism's strength is usually only calibrated to their primary position and in horizontal gaze or vertical gaze they are likely to be symptomatic. Assessment of this during the dispense will help explain the limitations of spectacles to the patient. Simply use a fixation pen and ask the patient if their diplopia worsens by assessing in the nine positions of gaze (**Figure 2**).

Hold the pen vertically when assessing horizontal diplopia and horizontally when assessing vertical diplopia. Ask the patient if they experience diplopia (as they may not see it at near) and if it worsens/breaks down in the different positions of gaze.

SPECTACLE LENS LIMITATIONS

Diplopia which changes in different positions of gaze could contraindicate certain lenses being dispensed. In multifocal spectacle lenses, downward gaze is usual for near vision. If a differing amount of prism is needed for near vision it could be missed when testing fixation disparity. Small aperture trial lenses can cause the patient to dip their chin rather than rotate their eyes as they would when using a PPL or bifocal (**Figure 3**). Identifying this could make a huge difference to lens options available to them.

It may be that the patient is only suitable for short corridor PPL designs as the diplopia is only experienced upon a more extreme downward gaze. It could, however, indicate that a different strength of prism is needed from primary gaze to where the eyes rotate for near fixation.

Prism which differs from distance to near has much fewer options where multifocal lenses are concerned and requires more of a specialised lens such as a Presto bifocal (a prism-controlled resin bifocal) or 'slabbing-on' vertical prism to create more/less prism when viewing the near visual point. With more limitations, it may well be that a patient is unsuitable for a certain lens design.

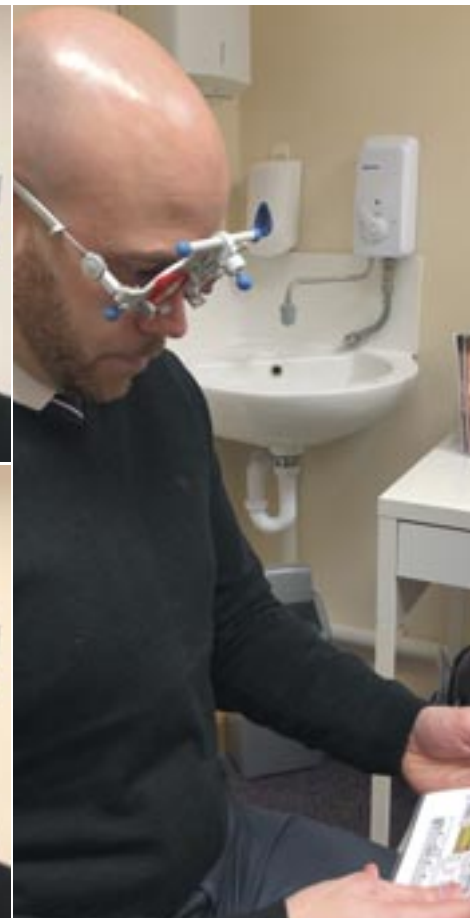
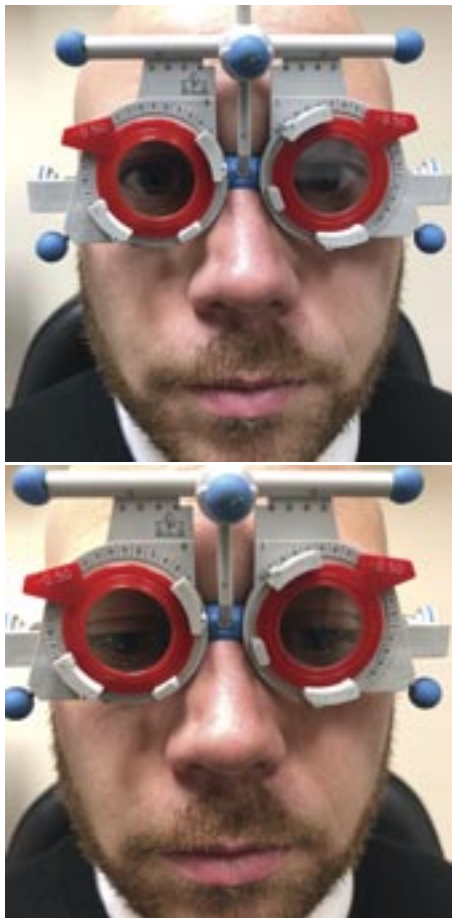


Figure 3. Demonstrating eye rotation in small aperture trial lens causing the need for chin depression instead of normal eye movement for near fixation

HEAD POSTURE

Some people are able to self-correct an incomitant deviation by adopting a head posture, effectively positioning the eyes away from the affected muscle(s) until realignment of the eyes occurs. These abnormal head postures can range from very obvious to extremely subtle. If obvious, they are more likely to be considered during assessment for prism. If subtle and missed, their prism strength will be lower than should be needed if their head was in a neutral position. Likewise if after collecting their specs a patient reports an improvement in symptoms/comfort when moving their head and, therefore, eyes into a different position, it should indicate to you that they are either over or under-corrected for prism strength.

These head postures often become habit and adapting to a prism which is calibrated to work without a head posture often takes some getting used to, something which should be advised prior to collection, again to manage the patients expectations.

AVOIDING ERRORS WHEN ORDERING

Prisms can be many practitioners' weakness and double-checking the prism bases against the clinical findings could prevent mistakes. When checking bases which have been ordered, remember exo requires base in, eso base out, hyper base down and hypo base up. Some practitioners will record vertical deviations as e.g. 'R/L' which means right eye is higher than left, or 'right hyper' (base down).

When splitting prism, remember horizontal bases remain the same and with vertical prism the opposite base is required for right and left or the prismatic effect is cancelled out. Be sure to check back through previous dispenses to see if bases have remained the same and the prescribing optometrist hasn't written them down in error.

It's also worth questioning any patient whose prisms have been significantly reduced or left out completely. Patients rarely cope when longstanding prism is taken away or

altered significantly. Identifying these errors before the spectacles are made could prevent further waiting for a patient who may not be seeing both clearly and binocularly, as well as preventing embarrassment/potential lack in faith by the patient and unnecessary costs.

AT THE COLLECT

Prism often needs adaptation time. Aligning the eyes when sitting very still looking straight ahead is different from moving eyes around in the real world. The muscles which have been working overtime to help align the eyes don't just stop as soon as the specs are worn. Again, if this is advised before someone collects their specs they will not be disappointed upon collection as they will have been pre-warned.

SUMMARY, MAKING A DIFFERENCE

Detecting potential issues before dispensing and managing the patient's expectations of what their

vision/binocular vision will be like in their new specs, will be of assistance in all aspects to follow – whether it is a patient putting their specs on and not adapting straight away to one having no binocular vision in certain positions of gaze. The patient should have made an informed decision knowing the likely limitations a pair of spectacles with single prism strength may have. If documented well, this can provide evidence if disputed after collection and prevent additional chair time and non-tolerance issues.

By adding a few extra checks when measuring a patient's CDs, a huge difference could be made to the patient's visual development and visual potential. Detecting a strabismus before centring spectacles could make the difference between allowing alignment of the eyes, and therefore the development of binocular single vision, versus the alternative – suppression and possible amblyopia.

These extra techniques may also influence lens availability, prevent false hope to patients who are unsuitable for certain solutions or manage their expectations allowing an informed decision that the spectacles they are about to purchase will not be perfect for complete correction due to the complicated nature of how their oculomotor system is functioning.

These pre-dispense discussions could save valuable chair time after collection, as well as reduce the potential for a patient to be unhappy with their specs or request a refund even though they are the best solution that can be achieved.

REFERENCES

1. Ansons A and Davis H. *Diagnosis and Management of Ocular Motility Disorders*. 4th ed. John Wiley-Blackwell; 2014; p. 229-231, 342-344.
2. Orge FH. *Strabismus Simulator*. 2015. Available from: www.aao.org/interactive-tool/strabismus-simulator [Accessed 7 February 2020]
3. Root T. *Tropias and Phorias – Part 1*. 2010. Available from: www.youtube.com/watch?v=dRYBOBSyzAU [Accessed 7 February 2020]
4. Root T. *Tropias and Phorias – Part 2*. 2010. Available from: www.youtube.com/watch?v=TxEQWtIXtrl&list=TLPQMDYwMjJwMjDVee0ZcdVylA&index=2 [Accessed 7 February 2020]

BEN MARCHANT studied orthoptics at Liverpool University, qualifying in 2009. During his training he worked at Moorfields, Manchester Royal and Glasgow Gartnavel. He worked for University Hospitals Birmingham for six years and became service lead at one of their sites for stroke and neuro rehabilitation. Ben obtained his FBDO status in 2018 and now works within his family's seven independent practices in the Midlands.

PLAN YOUR CET TODAY For all the latest CET events in your region, visit the Events section of the ABDO website.

The programme lists upcoming events, provides details of planned CET articles in *Dispensing Optics* and company information about CET sponsors. Events are also listed by month under the website Events tab.