

The role of the optometrist in dyslexia

Part 3 Coloured filters

This is the final article in a series of three papers to update eyecare practitioners on their role in dyslexia. The series is based on a recent book by the author¹.

Part 1 (OT, 30/01/04) provided an overview of specific learning difficulties, diagnosis of dyslexia, terminology, aetiology of dyslexia, types of dyslexia, non-specific learning difficulties, the role of visual symptoms and the evidence-based approach. *Part 2 (OT, 27/02/04)* concentrated on the diagnosis and treatment of two fairly common optometric findings in dyslexia – binocular instability and accommodative insufficiency. It also discussed other optometric factors (e.g. refractive errors and visual fields), the magnocellular deficit, the Dunlop test, behavioural optometry, and version eye movements and tracking.

This final part covers coloured filter treatments including syntonicon phototherapy, Meares-Irlen syndrome, the Intuitive Colorimeter™, mechanisms for the benefit from colour, clinical protocols, and a comparison of available systems. Finally, some conclusions are drawn on the role of the optometrist in dyslexia.

Syntonicon phototherapy

Syntonicon phototherapy is sometimes thought of as a sub-discipline of behavioural optometry. One of its key components involves the patient staring at a coloured light source. This is usually prescribed together with vision therapy and/or yoked prisms. It is argued that this treatment alters the autonomic nervous system, which in turn brings about a wide range of benefits, including a change in visual fields (see *Part 2*). There seems to be few believers in this approach these days, but there are a few followers in the UK. There also does not appear to be any randomised controlled trials of this intervention¹.

Meares-Irlen syndrome: initial claims

In 1980, Olive Meares suggested that some children's perception of text and certain cases of reading disabilities were influenced by print characteristics. She found that in some cases, the white gaps between the words and lines masked the print and caused visual perceptual anomalies, such as words blurring, doubling and jumping. She noted that this was helped by reducing the size of the print, using coloured paper, reducing contrast, or using white print on black paper.

Following these early reports, Helen Irlen established a proprietary system, based on Irlen Institutes, in several countries including

the USA, the UK and Australia, to detect and treat Irlen syndrome or 'scotopic sensitivity syndrome'. The latter term is probably inappropriate and, in view of the first detailed description of the syndrome by Meares, 'Meares-Irlen syndrome' seems to be the most appropriate term.

The condition is characterised by symptoms of eyestrain and visual perceptual distortions when reading. The eyestrain is said to occur predominantly with reading and is typified by sore, tired eyes, visual discomfort and headaches. The visual perceptual distortions include blurring, doubling, fading, shimmering, movement of words or letters, and seeing patterns and shapes on the page.

Meares-Irlen syndrome is treated with coloured filters, either coloured sheets (overlays) placed on the page or coloured lenses. An additional approach, for computer users, is to change the colour of the screen background and/or text. Another method, changing the colour of the illuminating light, is a possibility for people who consistently work under the same lighting conditions.

Irlen claimed that the required colour differed from person to person and was very specific: if a person was given coloured spectacles of a similar colour, but slightly different to their required colour, then they would receive much less benefit than with the appropriate colour². Proponents of the Irlen system claim that up to 60% of people with a reading problem, and 10% of 'good' readers, suffer from this disorder.

Intuitive Colorimeter and Wilkins/MRC system

One of the first scientists in the UK to take this subject seriously was Professor Arnold Wilkins, who was at the time based at the Medical Research Council (MRC) Applied Psychology Unit in Cambridge. He developed the Intuitive Colorimeter (**Figure 1**), an optometric instrument to systematically sample colour space. Hue, saturation, and luminance are independently varied whilst the patient views text. A unique feature of the instrument is that, because colours are changed gradually, people adapt to the colours so they are unaware of the precise colour that they are viewing.

The development of the Wilkins Intuitive Colorimeter meant that a double-masked, randomised placebo-controlled trial of Meares-Irlen syndrome became possible³.



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Module 1 Part 3 Dyslexia and vision

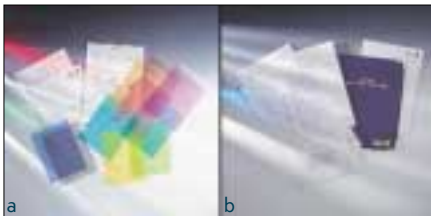
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❖ **Figure 1**

The Intuitive Colorimeter (reproduced with permission from Cerium Visual Technologies)



❖ **Figures 2a and 2b**

(a) Wilkins Intuitive Overlays and
(b) Wilkins Rate of Reading Test

(reproduced with permission from IOO Sales)

This trial demonstrated that individually prescribed filters could alleviate the symptoms of Meares-Irlen syndrome, and the benefit could not be solely attributed to a placebo effect. A second independent, double-masked randomised controlled trial, over a longer time period and using the Irlen system, showed that individually and precisely prescribed coloured filters improved performance at conventional measures of reading performance⁴. A third double-masked, randomised controlled trial supported the use of individually prescribed coloured filters for people with visually-precipitated migraine⁵.

There are now about 250 colorimeters in use worldwide and the patent is owned by the MRC in the UK. They are used in conjunction with Professor Wilkins' system of precision tinted lenses (PTLs) to make up lenses to match a given colorimeter setting. The tints are evenly spaced, based on the CIE UCS chromaticity diagram. A geometric progression is used, so that trial lenses can be stacked to obtain over 100,000 colours. They are combined in a logical way, like trial lens spheres, to reproduce and check tints.

A range of coloured overlays (Figure 2a) – Intuitive Overlays – has also been developed for screening, and a reading test (Figure 2b) – the Wilkins Rate of Reading Test – investigates the effect of coloured filters on reading. This new type of reading test was necessary because conventional reading tests were designed to measure

reading skills and to be relatively unaffected by visual factors (e.g. they used large text and widely-spaced lines). To assess visual factors, a new type of test was required with the opposite characteristics, i.e. greatly affected by visual factors but relatively unaffected by reading skills. The Wilkins Rate of Reading Test is just such a test and takes about five minutes to run.

In recent years, a great deal of research has been carried out with the the Wilkins Intuitive Overlays and the Wilkins Rate of Reading Test, which has been reviewed in the literature^{1,6}. Controlled trials show that individually prescribed coloured filters not only reduce symptoms of asthenopia, but also improve reading performance.

Meares-Irlen syndrome probably exists on a continuum, with many people being affected to a mild degree and fewer to a severe degree. Inevitably, estimates of the prevalence will vary depending on the severity of the condition one is seeking to detect. About 5% of all schoolchildren have a very marked degree of Meares-Irlen syndrome and will perform 25% faster at the Wilkins Rate of Reading Test with an overlay than without. The relationship with dyslexia is often overstated. Recent research suggests that Meares-Irlen syndrome is only a little more common in dyslexia than in good readers. But when Meares-Irlen syndrome co-exists with dyslexia, it will, of course, represent an added burden to people who already find reading difficult. Other studies have shown that Meares-Irlen syndrome affects adults almost as commonly as children¹.

Mechanism for the benefit from colour

Several potential mechanisms have been proposed to explain the benefit from coloured filters in Meares-Irlen syndrome. Some are based on a hypothetical link between the benefit from colour and other visual correlates of reading disability (e.g. binocular vision anomalies or the magnocellular deficit). However, until now these hypotheses have not been able to account for the high degree of specificity of the required colour, which has been stressed by Irlen and substantiated by double-masked, randomised placebo-controlled trials¹.

An alternative mechanism, initially proposed by Wilkins, is based on 'pattern glare'⁷. Striped patterns can be unpleasant to look at and some people experience eyestrain and visual perceptual distortions when viewing them. In fact, these symptoms are remarkably similar to those reported by patients with Meares-Irlen syndrome. The mechanism for these symptoms is likely to be a hyperexcitability of the visual cortex, which can also occur in some cases of migraine and epilepsy. Lines of print on a page form a striped pattern, which can have the spatial properties of a pattern which may cause pattern glare. It seems likely that this mechanism is

responsible for at least some patients' symptoms of 'visual stress' with reading.

Wilkins' theory is that people who benefit from precision tinted lenses have a visual cortex that is hyperexcitable⁸. In some, this hyperexcitability may lead to epilepsy and, more commonly, it may lead to migraine. In other people, the hyperexcitability may never result in either of these conditions, but may cause visual perceptual distortions and visual discomfort – sometimes described as visual stress. Some of the neurones in the visual cortex are sensitive to specific colours, and so varying the colour of the illuminating light may change the pattern of excitation within the cortex. This could account for the benefit from specific coloured filters⁶.

This theory has been further developed, linking it with the magnocellular deficit in dyslexia¹. There is considerable (but not unequivocal) evidence for a magnocellular deficit in many people with dyslexia (see Part 2). It would make sense if this deficit was related to the benefit from coloured filters, but there has been one major problem with making such a connection. This is that the magno system is not sensitive to specific colours, yet both double-masked randomised controlled trials of coloured filter treatments for reading difficulties show that the colour needs to be individually and precisely determined.

One theory, through a consideration of visual attention, links the visual stress theory of Wilkins and the magno deficit theory¹. Visual attention is a form of selective attention, which can be thought of as a 'spotlight' focussing our attention during reading on the word or group of small words around fixation. This spotlight of visual attention is believed to be mediated predominantly via the magno system, and there is evidence to suggest that the spotlight can be weakened in dyslexia. This would be expected to cause the person to experience more peripheral distractions on the page.

Text forms a striped pattern and striped patterns cause pattern glare, or visual stress. It is hypothesised that a weakened spotlight of visual attention will cause (a) the striped pattern from text to be more noticeable, causing more pattern glare and (b) the peripheral distortions resulting from pattern glare to be much more noticeable¹. Some of the symptoms reported by people with Meares-Irlen syndrome (e.g. seeing patterns on the page formed by the gaps between words) can also be observed (if they are looked for) by good readers who do not suffer from visual stress. An additional reason why people with reading difficulties might be more likely to notice these symptoms could simply be that they have trouble gathering meaning from the text, and are therefore more likely to be distracted by irrelevant patterns.

Recent research suggests that

individually prescribed coloured filters can also help people with visually precipitated epilepsy. One randomised controlled trial has also suggested that they can help reduce the frequency of headaches in people with visually precipitated migraine⁵. Clearly, precision tinted lenses are not a treatment for forms of migraine which do not have a visual trigger (e.g. those triggered by hormonal or dietary factors). But they can be an effective treatment for cases where there is a visual trigger (e.g. flickering light through trees, text, fluorescent lighting, computers). Migraine is common, affecting 8% of the UK population. So, migraine has become an important new use of the Intuitive Colorimeter and precision tinted lenses.

In summary, the term visual stress is nowadays proving to be more useful than Meares-Irlen syndrome. Visual stress can be defined as symptoms of eyestrain, headaches and visual perceptual distortions which occur when viewing repetitive visual stimuli, including text, and which are alleviated by individually prescribed coloured filters. The condition is believed to result from hyperexcitability of the visual cortex and is particularly prevalent in people with reading difficulties, migraine and photosensitive epilepsy. The diagnosis is one of exclusion; conventional optometric factors (e.g. refractive errors, orthoptic anomalies) need to be excluded first.

Clinical protocol

A clinical system is currently in operation where teachers, optometrists and psychologists screen children with coloured overlays. Children who show a sustained benefit from an overlay are then referred to an optometrist or hospital department which has a Wilkins Intuitive Colorimeter. Optometrists should first detect any pathology, which is very rare in these cases. Next, optometrists detect and treat any refractive and orthoptic problems, and then investigate the effect of

coloured filters. With children, overlays are tried first and coloured lenses are only prescribed once a definite benefit from the overlays has been demonstrated.

A definite benefit from coloured overlays can be demonstrated in one of two ways. First, the patient may be dispensed a coloured overlay of their preferred colour to use on a trial basis for up to one school term. If it genuinely reduces symptoms of eyestrain and headache, then the child is likely to continue to use it. Parents and teachers can look for an improvement in the reading fluency. The second method of detecting a genuine benefit from an overlay is to investigate the effect of the overlay on performance at the Wilkins Rate of Reading Test or using the Developmental Eye Movement (DEM) Test⁹. It should be noted that although the DEM test is claimed to be a measure of eye movements, this has not been demonstrated experimentally¹. The test requires subjects to rapidly identify randomly spaced numbers, and it is therefore not surprising that performance is improved by coloured filters which improve visual perception.

Data from the first 20,000 pairs of precision tints prescribed showed that the choice of colour was highly idiosyncratic – almost every conceivable colour was chosen by some people. This means that clinicians who wish to prescribe coloured lenses to people with reading difficulties need to test using a very large range of colours (like the Wilkins/MRC system or the Irlen system) to find the optimal colour. Testing with a small range of coloured filters is unlikely to find the optimal tint for every patient.

If only a small range of tints is used, the situation is analogous to carrying out a refraction using, for example, only nine different power trial lenses. The practitioner might be able to find a trial lens which helps the patient, but it will not necessarily be the best prescription for them. Precision tinted lenses need to be prescribed individually – in some cases with considerable

The Intuitive Colorimeter[®] Mk2

An instrument designed by the Medical Research Council for selecting the optimum colour for the relief of **Visual Stress** in

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Overlays are ideally used for initial screening of patients who exhibit symptoms of visual stress. Patients who gain benefit from a specific overlay should receive a full eye examination prior to assessment using the Intuitive Colorimeter. Research has shown that these patients will almost always obtain greater benefit from Precision Tinted Lenses[™] than from the overlay, and that the colour of the tinted lens will almost always be different from the colour of the over-

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precision. So, it is safest to use a validated system like the Wilkins Intuitive Colorimeter, or to refer to a colleague who has the appropriate equipment.

The effect of ambient lighting also needs to be considered. If a patient's tints need to be precisely defined, then the required colour will vary under different types of lighting. This effect (metamerism) is minimised if the dyes used to tint the lenses have smooth transmission curves, which is the case for Wilkins PTLs. This is one reason why commercial systems for providing PTLs should be fully described in the refereed scientific literature.

The final precision tinted lens specification can be checked under lighting which is similar to that where the patient usually works, if this is known. This is especially important for patients whose tint is light and who are found on clinical testing to be particularly precise in their choice of colour (like all clinical testing, the degree of precision varies from one patient to another). A freeware computer spreadsheet (available free of charge from www.essex.ac.uk/psychology/overlays/lens.htm) allows practitioners using the Wilkins Intuitive Colorimeter and PTLs to investigate the effect of different types of ambient lighting. This computer program also allows practitioners to check whether the tints protect the eyes adequately for use in sunlight, and to predict whether the tints are likely to influence the perception of traffic signals. This information is not usually required for children with dyslexia who are told to wear the tints only indoors, but the information is relevant for adults with visually precipitated migraine.

A clinical audit showed that, one year after being prescribed PTLs, 80% of patients were still using them daily¹⁰. This compared favourably with the continued use of conventional (untinted) spectacles in the same audit.

The colour which is required can gradually change over time, so it is usual to check the colorimetry result about once a year for children. Two years seems to be an appropriate interval for many adults, who usually recognise when their symptoms are returning. It seems that people who experience the symptoms of Meares-Irlen syndrome as children typically continue to experience some of these symptoms throughout life. In some cases, the symptoms reduce a little over the years and people may need their coloured spectacles

less, or even occasionally can do without them. There are several possible explanations for this. It is possible that cortical hyperexcitability might change over the years and the optical media of the eye certainly transmit less light with age. Additionally, people often become more able to change their environment. For example, they may be able to change the type of lighting, use a flat screen computer display, change to dictation software, or change the typographic features of text on the computer or on print-outs.

Can overlay colour predict tinted lens colour?

The optimal colour of tinted lens for a patient is usually different to their optimal overlay colour, and this has been explained by reference to colour adaptation. When a patient looks through coloured lenses (or into the Intuitive Colorimeter) they fully adapt to the colour, but when they look at a coloured sheet on the page they only partially adapt to the colour. This issue has been investigated in a controlled experiment which showed that tinted lenses should not be made up to match a preferred overlay colour for a person¹¹. In other words, to find the best colour for overlay, patients need to be tested with overlays, and to find the best colour for spectacles they need to be tested with lenses and/or with the Wilkins Intuitive Colorimeter.

Comparison of systems

There are now various proprietary systems available in the UK to prescribe coloured filters for people with reading difficulties. In addition to the Irlen and Wilkins systems, the Chromagen system has also been marketed for this purpose. Chromagen is a tinted contact lens system originally developed for use by people with colour vision defects. This use of the Chromagen system for 'correcting' colour vision defects has attracted considerable controversy, as have claims it can be used to treat people with dyslexia.

With the Chromagen system, patients are sometimes prescribed different colours for each eye. Some Chromagen practitioners say that patients commonly need different colours for each eye; others who use this system argue that almost all dyslexic users end up with the same colour for each eye. Unfortunately, this issue remains unresolved and there appears to be

no research to investigate whether patients do better with different tints or with the same tints in each eye. Indeed, since a cortical mechanism is believed to account for the benefit from coloured filters, it would be more logical to hypothesise that different colours are required for each hemifield rather than each eye. Although this would seem impractical from a prescribing point of view, it would be another interesting area to research.

The three systems available in the UK, which have been validated¹² with randomised controlled trials published in peer-reviewed journals are compared in Table 1. 'D-M RCT' is double-masked randomised placebo controlled trial. There is a masked controlled trial for the Irlen system and another for the Chromagen system, but it is unclear whether these were fully double-masked.

Three other approaches are also available in the UK, but these have not been investigated in published randomised controlled trials and so they are still best considered as experimental. The first is syntonics phototherapy. A different approach, TintaVision, uses a computer monitor to select overlays. Another method, Orthoscopies, involves instruments called the Read-Eye and the Optopraxometer. The TintaVision™ and Orthoscopies systems may both be confounded by the effects of colour adaptation and there appears to be no randomised controlled trials, or even full descriptions of these systems in the peer-reviewed literature (as evidenced by PubMed search using key words identified from manufacturers' websites, March 2004).

Conclusions

People with reading difficulties need to be managed by a multi-disciplinary team, in which optometrists play an important part. It is helpful if practitioners write reports about all the children they see who have difficulties at school. These reports can be sent to parents, class teachers, special needs teachers and educational psychologists. They should include information on any interventions which are needed, but are just as important when no abnormalities are detected. In addition to helping the children by improving communication, these reports will also help the practitioner. Teachers often report difficulties in finding eyecare practitioners who specialise in this field. The regular use of reports will help teachers to know where to send their

» Table 1

	Irlen	Wilkins/MRC	Chromagen
Screening	Overlays	Overlays	None
Testing: ability to find optimal tint	Very large range of colours	Very large range of colours	Nine colours
Validation	IDPS (unpublished proprietary system)	Wilkins Rate of Reading Test	Wilkins Rate of Reading Test
Established	1983	1993	c. 1997 for dyslexia
Design minimises metamerism	Probably not	Yes	Probably not
Availability of contact lenses	Yes	Yes	Yes
Practised by eyecare professionals	No	Yes	Yes
Research	Many papers, one M RCT	Many papers, two D-M RCTs	Two papers, one M RCT

children with specific learning difficulties.

Dyslexia is common, so clinicians should actively look for it. It is advisable to enquire about the reading and spelling of all patients who are of school age. When optometrists examine people with specific learning difficulties, it is helpful to take a detailed symptoms and history (see Table 1, Part 1). When examining people with (suspected) dyslexia, a very careful binocular and accommodative work-up is essential (see Part 2). Orthoptic exercises, where appropriate, can be helpful, although these are not likely to be required for the majority of people with dyslexia.

It is also appropriate to investigate the effect of coloured filters. Coloured overlays are a useful screening tool, but a range should be used which samples colours in a systematic and representative way (e.g. the Intuitive Overlays). Children who show a significant benefit from an overlay (either sustained use or a significant improvement in performance) are likely to benefit more from coloured lenses. Since these are worn on a more sustained basis, they should be prescribed with more precision, and the Intuitive Colorimeter is the only

instrument so far which has been validated for this purpose. The colour of the required lens is usually different to the colour of the optimal overlay and it is not appropriate to prescribe one from the other.

Dyslexic children require a specialist eye examination which, in addition to the tests in a routine (e.g. GOS) eye examination, should also include more detailed assessment of symptoms, binocular co-ordination, accommodative function and the effect of coloured filters. Typically, this testing takes about 45 minutes to one hour and most optometrists charge an additional fee, as outlined in the AOP document – *“Sight tests and eye examinations: Scope and charging”*¹³.

Dyslexia is primarily an educational problem and optometrists do not diagnose dyslexia, but they can detect visual problems which may co-exist and which may contribute to the patient’s overall difficulties. Optometric treatment will not remove the need for extra teaching. Although we may alleviate visual factors which can contribute to reading difficulties, we should not expect to be able to cure or treat dyslexia.

Ethical statement and acknowledgment

The author does not have a financial interest in any of the investigative tools, diagnostic instruments or coloured filter treatments described in this article. An earlier, shorter version of this manuscript was published by Optometric Educators as a distance learning article.

References

For a full set of references, email nicky@optometry.co.uk

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Module 1 Part 3 of the Dyslexia and vision series

The role of the optometrist in dyslexia

Part 3 Coloured filters

Please note there is only ONE correct answer

- Which one of the following statements about Meares-Irlen syndrome is true?
 - Different people need different colours, but a selection of nine colours is adequate
 - Once chosen, the colour which a person needs will stay the same throughout life
 - It can be helped by coloured filters, adjusting the set-up of computer screens, and changing the typographic features of text
 - People only need coloured filters for a short period and can then usually do without them
- Which one of the following statements best describes the key symptoms of Meares-Irlen syndrome?
 - Visual perceptual distortions, sore eyes, tired eyes, visual discomfort, headaches
 - Visual perceptual distortions, nausea, tired eyes, visual discomfort, headaches
 - Floaters, sore eyes, tired eyes, visual discomfort, headaches
 - Diplopia, sore eyes, tired eyes, visual discomfort, headaches
- Which one of the following terms has been used to describe Meares-Irlen syndrome?
 - Irlen syndrome
 - Scotopic sensitivity syndrome
 - Photopic sensitivity syndrome
 - (a) and (b)
- Which one of the following statements is true about the Wilkins Rate of Reading Test?
 - It is greatly influenced by reading skills, less so by visual factors
 - It is greatly influenced by visual factors, less so by reading skills
 - It is greatly influenced by reading comprehension, less so by reading speed
 - It takes about 15 to 20 minutes to administer

An answer return form is included in this issue. It should be completed and returned to: CPD initiatives (c4767c), OT, Victoria House, 178-180 Fleet Road, Fleet, Hampshire, GU51 4DA by April 21, 2004.

Under no circumstances will forms received after this date be marked – the answers to the module will have appeared in our April 23 issue and scores sent electronically to the accrediting bodies.

MCGs

- Which one of the following statements about the influence of different types of ambient lighting on the effect of coloured filters is most accurate?
 - Ambient lighting is irrelevant to the prescribing of coloured lenses, but is relevant for overlays
 - Ambient lighting is irrelevant to the prescribing of coloured overlays, but is relevant for coloured lenses
 - The influence is greater for saturated tints and less significant for lighter tints
 - The influence is minimised with Cerium precision tinted lenses because they have smooth transmission curves
- Which one of the following statements is not true about visual attention?
 - It is a form of selective attention
 - It can result in a sort of attentional ‘spotlight’
 - It is mediated predominantly by the magno system
 - It explains why green, but not blue, coloured filters help
- Which one of the following statements is true?
 - All dyslexic children who need coloured filters also need fusional reserve eye exercises
 - All dyslexic children who need eye exercises also need coloured filters

Continued overleaf

MCQs

Module 1 Part 3 of the Dyslexia and vision series (continued)

- c. All dyslexic children who use coloured overlays need assessment of binocular function
- d. Dyslexic children who have a coloured filter will not need eye exercises
8. Which one of the following statements is most accurate? Syntonic phototherapy is:
- a controversial treatment using individually prescribed coloured lenses
 - a controversial treatment where patients view a coloured light source, that is claimed to be effective through an influence on their reflexes
 - a controversial treatment where patients view a coloured light source, that is claimed to be effective through an influence on their cortical visual processing
 - a controversial treatment where patients view a coloured light source, that is claimed to be effective through an influence on their autonomic nervous system
9. In Meares-Irlen syndrome, the symptoms were first described in detail by whom?
- Arnold Wilkins
 - Helen Meares
 - Helen Irlen
 - Olive Meares
10. Which one of the following statements is true?
- 80% of people prescribed with precision tinted lenses still use them after one year
 - Astigmatic corrections cure Meares-Irlen syndrome
 - Tinted lens colour can be predicted from overlay colour
 - Overlay colour can be predicted from tinted lens colour
11. Which one of the following statements about pattern glare is most accurate?
- It is particularly prevalent in dyslexia
 - It is particularly prevalent in migraine and photosensitive epilepsy
 - It is explained by cortical hyperexcitability
 - All of the above
12. Which of the following groups of systems has been supported by randomised controlled trials?
- Intuitive Colorimeter, Orthoscopies, Irlen
 - Chromagen, Irlen, Intuitive Colorimeter
 - TintaVision, Intuitive Colorimeter, Irlen
 - Syntonic phototherapy, TintaVision, Orthoscopies

The role of the optometrist in dyslexia

Part 2 Optometric correlates in dyslexia

Here are the correct answers to Module 1, Part 2 which appeared in our February 27, 2004 issue.

1. What are the best two tests for detecting clinically significant binocular instability?
- Cover test and stereo-acuity
 - Cover test and fusional reserves
 - Stereo-acuity and fusional reserves
 - Fusional reserves and Mallett unit OXO test

d is correct

Binocular instability is characterised by low fusional reserves and vergence instability. The vergence instability is much more likely to be clinically significant if it occurs under fused conditions, such as with the Mallett OXO test which simulates normal reading conditions.

2. Which one of the following statements is most important? When carrying out the Mallett OXO test:

- the patient should be asked if the lines are perfectly aligned and if one or both ever move
- the patient should be asked if the lines are perfectly aligned and if they appear flat on the page
- the patient should be asked if the lines are perfectly aligned and if they are the same size
- the patient should be asked if the lines are perfectly aligned and if they appear the same colour

a is correct

It is probably not enough just to ask whether the Nonius markers (green strips) are lined up. Many of the patients, who would answer 'Yes' to this question, would also answer 'Yes' to a supplementary question: "Do one or both of the lines ever move?" This latter question is the best way of identifying patients who are likely to have symptoms (Karania and Evans, in preparation). If one of the Nonius markers moves, then the direction of movement is identified and the aligning prism or sphere is determined. This is the prism (base-in for an exo-slip) or sphere (negative for an exo-slip) which eliminates movement of the strip.

3. Which one of the following statements is most accurate? The amplitude of accommodation:

- is always low in dyslexia
- is more likely to be low in a poor than in a good reader
- if poor, should be treated by prescribing negative lenses in spectacles to stimulate accommodation
- can be treated by training convergent fusional reserves with free-space stereograms

b is correct

The amplitude of accommodation is not always low in dyslexia, but in matched group studies it has been found to be lower on average in children who are dyslexic than in good readers. A low amplitude of accommodation is not usually treated by

prescribing negative lenses or by fusional reserve exercises.

4. Which one of the following statements is true? MEM retinoscopy:
- stands for minimum eye retinoscopy
 - diagnoses dyslexia
 - is carried out whilst the patient fixes with both eyes
 - is carried out whilst the patient wears the subjective refractive findings

c is correct

The accommodative lag can be measured by retinoscopy using the monocular estimate method (MEM). The subject binocularly fixates a detailed target on the retinoscope and is asked to keep this clear. Retinoscopy is carried out along the horizontal meridian and lenses are very briefly held in front of each eye to neutralise the retinoscope reflex. Each lens should only be present for a split second so as not to disrupt the status of the patient's accommodative and binocular response. As far as possible, the test simulates normal viewing conditions so the patient typically only wears a refractive correction if they would usually do so to read.

5. Which one of the following statements is true? Binocular instability is:

- more common in poor than in good readers
- a major cause of dyslexia
- cured by prescribing tinted lenses
- an exophoria at near combined with an esophoria at distance

a is correct

Research suggests that binocular instability is more common in children with dyslexia than in children who are good readers, but it is unlikely to be a major cause of dyslexia. When people with reading problems have a detailed investigation by an optometrist, many are found to need no optometric intervention at all. Some have Meares-Irlen syndrome and are helped by coloured filters, and a few need eye exercises (for example, for binocular instability). Binocular instability and Meares-Irlen syndrome are separate conditions, although occasionally children are encountered who suffer from both. However, they are by no means invariably associated with one another.

6. Which one of the following statements is NOT true?
- There are 41 accredited behavioural optometrists listed in the UK
 - Some behavioural optometrists prescribe low plus lenses to many children
 - Some behavioural optometrists prescribe eye exercises to train saccadic eye movements to many children
 - A thorough review in 2000 criticised behavioural optometry because there were only a few double-masked randomised controlled trials

d is correct (i.e. not true)

The British Association of Behavioural Optometrists lists 41 accredited behavioural optometrists in the UK, although undoubtedly this underestimates the number with an interest in this field. Behavioural optometry describes a broad range of activities, including prescribing low plus lenses to children and training saccadic eye movements. There is a large body of research on behavioural optometry, but a lack of double-masked randomised placebo-controlled trials. A thorough review by Jennings (2000) noted that "In the behavioural optometry literature, I have found no randomised controlled trials".

7. On the Mallett OXO test, what is the lowest magnitude of aligning prism that is likely to be associated with symptoms in pre-presbyopes?
- 0.5 Δ
 - 1 Δ
 - 2 Δ
 - 3 Δ

b is correct

Research carried out in the Optometry Department at Bradford University found that in pre-presbyopes, if an aligning prism of 1 Δ or more is detected at near then there are likely to be symptoms. For presbyopes, the best cut-off was 2 Δ .

8. Which one of the following is a strong correlate of dyslexia?

- Astigmatism
- Visual field anomalies
- Convergence insufficiency
- None of the above

d is correct

It is hard to find an optometric variable which has not, at some time, been claimed to be a correlate of dyslexia. However, refractive errors have not been found in controlled studies to be a strong correlate of dyslexia. Similarly, although it has been claimed that visual fields when measured with kinetic perimetry can sometimes be abnormal in dyslexia, the evidence for this is quite weak and the available research suggests that visual field anomalies are not a strong correlate of dyslexia. One or two studies have found convergence insufficiency to be a correlate of dyslexia, but others have not. Convergence insufficiency is so common that it is likely to be found in many people with dyslexia, even if it is not specifically associated with this condition.

9. Which one of the following statements is NOT true?

- The term oculomotor refers to the third cranial nerve
- The term ocular motor refers to all movements of the eyes
- The term oculomotor refers to vergence but not saccadic eye movements
- The oculomotor nerve is involved in accommodation

c is correct

The term oculomotor can be the source of some confusion. Literally, it refers to the third cranial nerve, which controls most but not all of the extra-ocular muscles and is involved in accommodation and pupillary function. In the biological sciences, the term motor refers to movement, so ocular motor literally refers to movements of the eyes. Confusingly, the term oculomotor is used by some authors to refer specifically to saccadic eye movements.

10. Which one of the following statements is true about the magnocellular system?

- Its functions show no overlap with the parvocellular system
- It is predominantly sensitive to fine detail
- It is slower than the parvocellular system
- It is more sensitive to low contrast targets than the parvocellular system

d is correct

The function of the magnocellular system were summarised in Table 1. It should be stressed that there is considerable overlap between the functions of the two systems.

11. Which one of the following statements is true about the Dunlop test?

- It is a test of motor ocular dominance
- It is popular because of its reliability
- It is a test of sighting ocular dominance
- It is carried out with a Maddox wing test

a is correct

Ocular dominance can be measured in a variety of ways, and each method may give a different result in a given person. Tests of ocular dominance can be broadly classified into sighting, motor and sensory. The Dunlop test is a test of motor ocular dominance. It was originally carried out with a synoptophore, although a Mallett unit can be used for a modified version of the test. The Dunlop test was widely publicised and quite often used 10 to 20 years ago but, partly due to concerns about the reliability of the test, it is much less commonly used these days.

12. Which one of the following statements is true about saccadic eye movements?

- They are unique to reading
- They are used for most activities
- They can only be made from right to left in dyslexia, hence the reading eye movements are abnormal
- They need training in dyslexia so that the necessary eye movements for reading can be learned

b is correct

Saccades are a fundamental type of eye movement used in almost all everyday activities. They are not unique to reading, although the fairly regular repetitive pattern of saccadic eye movements in reading is not typical of many other tasks. There are some reports of occasional cases of people with dyslexia who have an almost inexorable tendency to move the eyes from right to left, which interferes with their normal reading. But these cases appear to be very much the exception rather than the rule in dyslexia. The notion that dyslexic people benefit from saccadic eye movement training is controversial, and some interesting recent research from a team in Germany has re-awakened interest in this field. However, this is certainly not a mainstream treatment for dyslexia at present.

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