Pattern Glare Test

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The Pattern Glare Test was first produced in 2001 in response to requests from optometrists. It is helpful in identifying patients susceptible to *pattern glare*, i.e. perceptual distortions and discomfort from patterns.[1] Such patients are prone to *visual stress (Meares-Irlen syndrome)* and are likely to find coloured filters useful.[2,3]

The perceptual distortions reported in response to patterns with specific spatial parameters have been shown to be associated with headaches and 'eye-strain' in various ways:

- People who see many distortions tend to report more headaches. This association holds only for patterns with particular parameters (those of Pattern 2), so it is not attributable simply to response bias.[4]
- People see more distortions on days when they are going to have a headache, up to 24 hours before.[5]
- If the headaches are on one side of the head then, in between headaches, the distortions predominate on one side of the pattern.[4]
- In migraine with aura, the distortions are greater in the lateral visual field in which the aura occurs.[6]
- Patients with migraine find Pattern 2 aversive.[7]

In addition:

- The distortions are greater in individuals with impaired flicker perception.[8]
- Patients who benefit from coloured overlays or lenses have increased levels of pattern glare.[2,3,9,10,11]

In the various research studies cited above the details of the method of testing for pattern glare varied. The Pattern Glare Test described in this manual was based on previous work, but was developed to encourage a standardised approach and to facilitate clinical testing.

The associations between headaches and perceptual distortions occur predominantly for Pattern 2 in the Pattern Glare Test. This pattern has a spatial frequency close to that at which contrast sensitivity is greatest, i.e. 2-5 cycles per degree visual angle (cpd), at which each stripe subtends about 10 minutes of arc. When the spatial frequency is lower (e.g., 0.5 cpd) relatively few distortions are reported and they are not associated with headaches and eye-strain.[4] Individuals who complain of many symptoms of visual discomfort in everyday life will usually report more distortions in response to gratings with a mid spatial frequency (2-5 cpd) as compared with gratings that have higher and lower spatial frequencies. Individuals with relatively low visual discomfort, on the other hand, will usually report more distortions in response to a high spatial frequency (e.g., 9-12 cpd) grating than a mid spatial frequency grating,[12] although they may report fewer distortions overall. The nature of the distortions in the high spatial frequency grating may differ from those in the mid spatial frequency grating, reflecting a greater relative contribution from optical as opposed to neurological factors. A possible relationship is summarised in the table below, where SF refers to spatial frequency.

Visual discomfort in everyday life	**Discomfort and distortions in response to**		
	Pattern 1 (low SF)	**Pattern 2 (mid SF)**	**Pattern 3 (high SF)**
Low / moderate	+	+ +	+ + +
High	+	+ + + +	+ + +

Design and use of the Pattern Glare Test

The method of testing for pattern glare is extremely simple. The patient is asked to view a fixation dot at the centre of a pattern for five seconds and to answer a series of seven questions about any distortions they perceive (e.g., shimmering, fading). The number of "yes" responses is

summed to give a score for the pattern glare. The score sheet attached to this manual can be photocopied. Testing should start with Pattern 1 and end with Pattern 3.

The recommended viewing distance is 40cm, although it is not necessary for this to be precisely controlled and typically the patient is allowed to hold the test at their usual reading distance. In view of this, previous editions of the test quoted approximate spatial frequencies for each grating. This led to some inaccuracies in the values that were cited for the spatial frequencies of the gratings in the literature (e.g., Evans and Stevenson, 2008)[13] and accurate values for different working distances are now given in the table below.

Grating (sf)	test distance (cm)	cpd
Pattern 1 (low)	40	0.3
Pattern 2 (mid)	40	2.3
Pattern 3 (high)	40	9.4
Pattern 1 (low)	50	0.3
Pattern 2 (mid)	50	2.8
Pattern 3 (high)	50	11.8
Pattern 1 (low)	60	0.4
Pattern 2 (mid)	60	3.4
Pattern 3 (high)	60	14.2

Interpreting the results

Evans and Stevenson (2008)[13] obtained norms for the Pattern Glare Test. They found that 95% of normal patients will obtain a score of less than 4 on Pattern 2. Moreover, if the sum of distortions experienced with Pattern 3 is subtracted from the sum of distortions with Pattern 2, then 95% of normal patients will obtain a difference score of less than 2. Patients with higher scores than these values are at risk of *visual stress (Meares-Irlen syndrome)* in everyday life and may benefit from interventions designed to alleviate visual stress. Children with reading difficulties should be tested with the *Intuitive Overlays* and/or the *Intuitive Colorimeter.* Adults and children with migraine should be tested with the *Intuitive Colorimeter.*

Patients with migraine who benefit from coloured filters usually show a reduction in pattern glare with the filters.[11] When people with pattern glare use the appropriately coloured filters there is an associated improvement in performance.[2,8,13,14]

REFERENCES

[1] Wilkins, A.J. and Nimmo-Smith, M.I. (1984). On the reduction of eye-strain when reading. *Ophthalmic and Physiological Optics*, **4**, 53-59.
[2] Hollis, J. and Allen, P.M. (2006). Screening for Meares-Irlen sensitivity in adults: can assessment methods predict changes in reading speed? *Ophthalmic and Physiological Optics*, **26**, 566-571.
[3] Allen, P.M, Hussain, A, Usherwood, C, Wilkins, A.J. (2010). Pattern-related visual stress, chromaticity and accommodation. *Investigative Ophthalmology and Vision Science*, in press.
[4] Wilkins, A.J., Nimmo-Smith, M.I., Tait, A., McManus, C., Della Sala, S., Tilley, A., Arnold, K., Barrie, M., Scott, S. (1984). A neurological basis for visual discomfort. *Brain*, **107**, 989-1017.
[5] Nulty, D., Wilkins, A.J. and Williams, J.M. (1987). Mood, pattern sensitivity and headache: a longitudinal study. *Psychological Medicine*, **17**, 705-713. Also Neary and Wilkins (unpublished data).
[6] Khalil, N. (1991). *Investigations of visual function in migraine by visual evoked potentials and visual psychophysical tests.* Unpublished PhD Thesis, University of London.
[7] Marcus, D.A. and Soso, M.J. (1989). Migraine and stripe-induced visual discomfort. *Archives of Neurology*, **46**, 1129-1132.
[8] Evans, B.J.W., Cook, A., Richards, I.L. and Drasdo, N. (1994). Effect of pattern glare and coloured overlays on a simulated reading task in dyslexics and normal readers. *Optometry and Vision Science*, **71**(10), 619-628.
[9] Evans, B.J.W., Wilkins, A.J., J. Brown, A. Busby, A. Wingfield, R. Jeanes and J. Bald (1996). A preliminary investigation into the aetiology of Meares-Irlen syndrome. *Ophthalmic and Physiological Optics*, **16**, 286-296.
[10] Evans, B.J.W., Busby, A., Jeanes, R. and Wilkins, A.J. (1995). Optometric correlates of Meares-Irlen syndrome: a matched group study. *Ophthalmic and Physiological Optics*, **15**, 481-487.
[11] Evans, B.J.W., Patel, R., Wilkins, A.J.W. (2002) Optometric function in visually-sensitive migraine before and after treatment with tinted spectacles. *Ophthalmic and Physiological Optics***, 22**, 130-142.
[12] Conlon, E., Lovegrove, W., Barker, S., Chekaluk, E. (2001). Visual discomfort: The influence of spatial frequency. *Perception*, **30**(5), 571-581.
[13] Evans, B.J.W., Stevenson, S.J. (2008). The Pattern Glare Test: a review and determination of normative values. *Ophthalmic and Physiological Optics*, **28**, 295-309**.**
[14] Allen, P.M. Gilchrist, J.M. and Hollis, J. (2008). Use of visual search in the assessment of pattern-related visual stress (PRVS) and its alleviation by coloured filters. *Investigative Ophthalmology and Vision Science*, **49**(9), 4210-4218.

Record Sheet

Circle patient's response: B=both sides;
L=predominantly left side; R=predominantly right side

Perceptual distortion	**Pattern 1**	**Pattern 2**	**Pattern 3**
Colours	B L R	B L R	B L R
Bending of lines	B L R	B L R	B L R
Blurring of lines	B L R	B L R	B L R
Shimmer / flicker	B L R	B L R	B L R
Fading	B L R	B L R	B L R
Shadowy shapes	B L R	B L R	B L R
Other effects (Please specify)			

The page below is the front page of instructions in the actual test booklet.

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Caution

Pattern 2 may cause bodily symptoms such as nausea and dizziness if exposed for more than a few seconds, particularly in individuals with migraine. In a few patients with photosensitive epilepsy it may cause seizures. **PATIENTS WITH EPILEPSY SHOULD NOT BE EXPOSED TO THE PATTERN**.

Instructions for use

1. Familiarise the patient with the test by reading out the check list of distortions above Pattern 1. The test should be held at a distance of approximately 40cm from the patient's eyes.

Tell them to look at the dot in the centre of the pattern. Allow them to look for 5 seconds, counting to yourself. Then ask each question in turn, allowing the patient to avert gaze if they are uncomfortable.

2. For any reported distortions you can ask the patient if the distortions were equal on both sides of the vertical line, or more pronounced on one side. Note their response.

3. Repeat this procedure for Pattern 2 and then Pattern 3.