Specific learning difficulties: the role of the optometrist

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Overview of LD & SpLD

- Profound learning disabilities (PLD): usually low IQ & disabilities in several academic areas
  - e.g., Down’s syndrome, cerebral palsy
  - a.k.a., Intellectual impairment (Shute, 1991)

- Specific learning difficulties (SpLD): specific difficulties with certain activities. IQ may be normal
  - e.g., dyslexia, dyspraxia

- Problems with classification
  - e.g., autism
  - In USA, LD=SpLD

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Background
- Polarised views on vision & dyslexia
- Zealots: middle view
- Deniers: Vision irrelevant to dyslexia
- maybe visual problems can co-occur with dyslexia
- Vision stress major cause of RD
- Visual stress does not exist
- maybe sensory visual stress can co-occur with dyslexia
- Evans et al. (1994)
  - Dyslexic children are significantly more likely to report text transient blurring (26% vs 9%) & doubling (23% vs 7%)
  - N.B., most dyslexics don’t have visual symptoms
  - Study concluded that visual factors are “not a major cause of the dyslexia”
  - Eliminating any visual symptoms is likely to be helpful

Role of visual factors in dyslexia
- Dyslexia is a learning difficulty that primarily affects the skills involved in accurate and fluent word reading and spelling (Rose, 2009)
- Characteristic features of dyslexia are difficulties in phonological awareness, verbal memory & verbal processing speed (Rose, 2009)
- Visual problems are not “the cause” of dyslexia
  - The term “visual dyslexia” is a misnomer
  - Visual problems may contribute to reading difficulties
  - In these cases visual treatments may help

Disclosure
- Funding for lectures, KOL/product feedback, research:
  - Lecture content always my own
  - I.O.O. Slaters Ltd
  - Markets IFS orthoptic exercises, which the speaker designed, and for which he receives a small royalty
  - Community optometric practice in Brentwood, Essex


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Optometric correlates of reading difficulties: binocular instability

**SYMPTOMS:** blur, double vision, visual perceptual distortions, eye strain & headaches

**SIGNS:** low fusional reserves, unstable heterophoria

Prevalence: circa 15% in dyslexia; c.f., 5% good readers (so, not found in 85% of dyslexics)

Treatment: does not always require treatment: fusional reserve exercises, refractive correction

Evidence: moderate for correlate; weak for cause

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Do eye exercises improve fusional reserves?

1a. Systematic review of homogenous RCTs
1b. Individual RCT with good CI
2a. Systematic review of homogenous cohort studies
2b. Individual cohort study
3a. Systematic review of case control studies
3b. Individual case control study
4. Case series
5. Expert opinion

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Do base in prisms work? – depends on test used

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**Plan**

**Introduction**

Conventional optometric correlates

Magnno (transient) visual deficit

Behavioral optometry

Sensory visual stress

Conclusions

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**Magno & parvo sub-systems**

(Transient and sustained)

<table>
<thead>
<tr>
<th>magno system is predominately</th>
<th>parvo system is predominately</th>
</tr>
</thead>
<tbody>
<tr>
<td>rapid</td>
<td>slow</td>
</tr>
<tr>
<td>low acuity</td>
<td>high acuity</td>
</tr>
<tr>
<td>low contrast</td>
<td>high contrast</td>
</tr>
<tr>
<td>colour insensitive</td>
<td>colour sensitive</td>
</tr>
</tbody>
</table>

Dyslexia is correlated with a deficit of the magno-cellular visual sub-system

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**Dyslexia: linking the visual deficits (a)**

- Magno visual deficit is correlated with binocular instability (Evans et al., 1996)

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**Dyslexia: linking the visual deficits (b)**

- BUT, magno system is not colour-specific

- Magno deficit is not directly related to the benefit from coloured filters

  - Evans et al., 1994
  - Evans et al., 1995
  - Simmers et al., 2001
  - Winder et al., 2005
  - Conlon et al., 2009

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**Behavioral optometry**

- Detailed symptomatology
- Holistic approach
- Good orthoptic assessment & treatment
- Eye movement assessment & treatment
- Perceptual-motor and gross co-ordination exercises
- “learning lenses”
- Photo-syntonics

Weak evidence

Jennings (2000)

Barrett (2008)

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Behavioral optometry

- As many therapies as there are practitioners
- "no randomised controlled trials" (Jennings, 2000)
- "a large majority of behavioral management therapies are not evidence-based" (Barrett, 2008)
- Doubt is not a pleasant condition, but certainty is an absurd one (Voltaire)

"Tracking" & dyslexia

- Saccades are not unique to reading
- Most studies have not found a saccadic eye movement deficit in dyslexia
  - Dyslexia influences saccades: "search for meaning"
  - ADD influences saccades
- The OSG test does not measure eye movements (Ayton et al., 2009; Webber et al., 2011)
- Poor DEM scores do not mean that reading difficulties result from poor eye movements (Webber et al., 2011)
- Treatments based on training saccadic or pursuit eye movements are controversial
- The DDAT has not been validated by masked controlled trials (PubMed search 15-Oct-06)

Is vision therapy for saccades effective?

1. Systematic review of homogenous RCTs
2. Individual RCT with good CI
3. Systematic review of homogenous cohort studies
4. Individual cohort study
5. Systematic review of case control studies
6. Individual case control study
7. Systematic review of case control studies
8. Expert opinion

Visual Stress = symptoms + benefit from colour

a.k.a. Scotopic Sensitivity Syndrome, Irlen Syndrome

Meares-Irlen Syndrome / Sensory Visual Stress (SVS)

Plan

INTRODUCTION

CONVENTIONAL OPTOMETRIC CORRELATES

MAGNO (TRANSIENT) VISUAL DEFICIT

BEHAVIORAL OPTOMETRY

SENSORY VISUAL STRESS (SVS)

CONCLUSIONS

Handout from www.bruce-evans.co.uk for regular tweets on optometric research.
Why might the tints help?

\[
\text{Successful treatment} = \text{Placebo only} + \text{Treatment effect}
\]

Evans & Drasdo (1991)  
Evans (1994)  
Wilkins & team

The Intuitive Colorimeter

Wilkins et al. (1992)

Precision Tinted Lenses (PTL)

Wilkins et al. (1992)

Intuitive Overlays

Wilkins. (1993)

NOTE: OVERLAY COLOUR DIFFERS FROM LENS COLOUR

Figures courtesy of Prof. Arnold Wilkins
Assessing optometric interventions

Wilkins Rate of Reading Test

Wilkins Rate of Reading Test

Wilkins et al. (1996) Optical Physiol Opt 46, 491-497

Key research on sensory visual stress (SVS) with the “Intuitive” system

- PTL can alleviate symptoms when reading
  Wilkins, Evans, Buxby et al. (1994)
- Overlays associated with improved speed of reading
  Wilkins et al. (1996); Bouldoukian, Wilkins, Evans (2002)
- Overlays may improve visual performance
  Evans et al. (1994); Singleton & Henderson (2007); Allen et al. (2008)
- Binocular & accommodative anomalies need to be detected (Schuman et al., 1994): But VS is an independent sensory dysfunction
  Evans, Wilkins, Buxby et al. (1996); Scott et al. (2002)
- The benefit from PTL is linked to pattern glare
  Evans et al. (1994, 1996); Singleton & Henderson (2007); Allen et al. (2008)

Key research of VS with the “Intuitive” system (cont)

- >80% of people prescribed PTL report still using after one year
  Evans, Patel, Wilkins et al. (1999)
- Lens colour is different to overlay colour
  Lightomo, Lightomo, Wilkins (1999)
- VS appears to be about 2.3x more common in dyslexic children than non-dyslexic (c. 20% of dyslexics)
  Kria & Evans (2000); Evans & Allen (2016)
- Delphi study proposed diagnostic criteria
  Evans, Allen, Wilkins (2017)

Pitfalls in researching VS

- Research the target condition
  Menacker et al. (1990); Henderson et al. (2012) researched dyslexics
  Mitchell et al. (2008) did not study people with VS
  Bouldoukian et al. (2002) studied participants who “reported relief from overlays”
- Ritchie et al. (2013) used an Irlen diagnostic process which found 77% of poor readers
- Prescribe colour individually, allowing for a degree of precision
  Menacker et al. (1990) & Ritchie et al. (2013) used limited range of colours
  Debate ongoing concerning precision (e.g., Suttle et al., 2017)
  Clinically, precision varies but is required by some patients
- Use appropriate outcome measures
  Ritchie et al. (2011) used enlarged WHRT test
- Systematic reviews with inappropriate selection criteria will reach negative conclusions (e.g., Griffiths et al., 2016)
  BUT, in part owing to these issues, VS is still controversial

Conservative clinical practice

- Listen to symptoms but don’t over-treat
  - This applies to SVS & conventional optometric anomalies
- Beware favourite colour & gender effects
  (Conway, Evans, Evans, Suttle; 2016)
- Solution for many is digital devices

Representation of colour in macaque area V2

- Used optical recording & confirmed with electrode recording
- Identified “colour-prefering” modules
- Did not overlap with “orientation-prefering modules”
- Each contour illustrates the cortical region giving the maximal response to each tested colour
  - But different colours produce different response magnitudes

Naco et al., 2005, Nature
Pattern glare

Do individually prescribed filters help alleviate visual stress? – evidence too weak to be sure

Conclusions

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