Dyslexia and vision

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

Plan

INTRODUCTION
CONVENTIONAL OPTOMETRIC CORRELATES
MAGNO (TRANSIENT) VISUAL DEFICIT
BEHAVIORAL OPTOMETRY
MEARES-IRLEN SYNDROME & VISUAL STRESS
CONCLUSIONS

Handout from www.bruce-evans.co.uk for regular tweets on optometric research

Background
- Polarised views on vision & dyslexia
  - Zealots middle view Deniers
  - Visual factors cause dyslexia Vision irrelevant to dyslexia maybe visual problems can co-occur with dyslexia
  - Visual stress major cause of RD Visual stress does not exist maybe visual stress can co-occur with dyslexia
  - Evans et al. (1994)
    - Dyslexic children are significantly more likely to report transient blurring (26% of 9%) & doubling (23% of 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

Which eyecare practitioner?
- Dispensing Opticians (5,100 in UK)
  - Dispense spectacles
  - Some also fit contact lenses
- Orthoptists (1,000 in UK)
  - Mainly involved in orthoptics (binocular vision)
  - Some also do vision screening
**Which eyecare practitioner?**

- Ophthalmologists
  - In UK: 900 consultants; 1,400 in training
- Optometrists (10,400 in UK)
  - Detect eye diseases
  - Detect & treat refractive & orthoptic problems
  - Prescribe glasses & contact lenses

**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

**PLAN**

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**Visual factors that do not correlate with dyslexia**

- Ocular pathology
- Visual acuity
- Refractive error
- Colour vision defects
- Strabismus

**Optometric correlates of reading difficulties: binocular instability**

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

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

SIGNS: low fusional reserves, unstable heterophoria

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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 phoria relieved by monocular occlusion

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

**TREATMENT:** does not always require treatment

**EVIDENCE:** moderate for correlate; weak for cause


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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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**“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 DEM 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 (Medved et al. 2010)
- 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-09)
- “Reynolds et al. (2003) provides no evidence that DDAT is an effective form of treatment” (Snowling & Hulme, 2003)

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Visual Stress = symptoms + benefit from colour
a.k.a. Scotopic Sensitivity syndrome, Irlen syndrome
Meares-Irlen Syndrome / Visual Stress (MISVis)

Why might the tints help?

Why might the tints help?

The Intuitive Colorimeter

Try these colour change continuous
Assessing optometric interventions

Wilkins Rate of Reading Test

- PTL may alleviate symptoms when reading
  - Wilkins, Evans, Busby et al. (1994)
- Overlays associated with improved speed of reading
  - Wilkins et al. (1996); Boudoukian, 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
  - (Scheiman et al., 1990)
- MISVIS appears to be about 2-3x more common in dyslexic children than non-dyslexic
  - [c. 20% of dyslexics]
  - Kriss & Evans (2005); Evans & Allen (2016)
- Delphi study proposed diagnostic criteria
  - Evans, Allen, Wilkins (2017)

Key research with the “Intuitive” system

- >80% of people prescribed PTL report still using after one year
  - Evans, Patel, Wilkins et al. (1999)
- Lens colour is different to overlay colour
  - Lightstone, Lightstone, Wilkins (1999)
- Prescribe colour individually, allowing for a degree of precision
  - Menacker et al. (1993) & Ritchie et al. (2011) used an Irlen diagnostic process which found MISVIS in 77% of poor readers

Pitfalls in researching MISVis

- Research the target condition
  - Menacker et al. (1993) & Henderson et al. (2012) researched dyslexics
  - Mitchell et al. (2005) did not study people with MISVIS
- Boudoukian et al. (2002) studied participants who “reported relief from overlays”
- Ritchie et al. (2011) used an Irlen diagnostic process which found MISVIS in 77% of poor readers
- Pitfalls in researching MISVis

- Use appropriate outcome measures
  - Ritchie et al. (2011) used enlarged WRRT text

- Systematic reviews with inappropriate selection criteria will reach negative conclusions (e.g., Griffiths et al., 2016)
  - BUT, in part owing to these issues, MISVIS is still controversial
Conservative clinical practice

- Listen to symptoms but don’t over-treat
  - This applies to VS & conventional optometric anomalies
- Beware favourite colour & gender effects
- Solution for many is digital devices

Sequential management plan: optometrist with overlays

Evans, Allen, Wilkins (2016);
Conway, Evans, Evans, Suttle (2016);
Evans & Allen (2016);
Evans (1994); Lightstone & Evans (1995); Evans et al. (1999); Allen, Evans, Wilkins (2010)

Pattern glare

High prevalence in:
- Autism
- Migraine
- Photosensitive epilepsy
- Autism

DO NOT VIEW THIS IF YOU HAVE EPILEPSY OR MIGRAINE

Representation of colour in macaque area V2

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

Evans (1994); Lightstone & Evans (1995); Evans et al. (1999); Allen, Evans, Wilkins (2010)

Visual stress

PREVALENCE: c. 20% of people with dyslexia

SYMPTOMS: eyestrain, headaches, visual perceptual distortions (text moves & blurs)

SIGNS: diagnosis of last resort – rule out other causes of symptoms
  - coloured overlays alleviate symptoms

TREATMENT: coloured filters or coloured background

EVIDENCE: debated & controversial
  - evidence is weaker than would be required for a new drug or for surgery
Comparison of main systems

<table>
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<th>Feature</th>
<th>Intuitive Colorimeter</th>
<th>Irlen</th>
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<tbody>
<tr>
<td>Screening</td>
<td>Pattern glare test,</td>
<td>Overlays</td>
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<tr>
<td>Testing: ability to</td>
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<td>find optimal tint</td>
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<td>Availability of contact</td>
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<td>lenses</td>
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<tr>
<td>Meet SASC 2018 guidelines</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Research</td>
<td>Many papers, small D-M RCT</td>
<td>Many papers, small D-M RCT</td>
</tr>
</tbody>
</table>

Low precision: Oxford filters, HappyEyes, ReadEz, Chromagen, Photosyntics
Unproven techniques: Optopraxometer & Orthoscopics

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Conclusions

- A minority of people with reading difficulties report visual symptoms:
  - Does text appear to move, blur, or cause headaches?
- If symptoms, suspect:
  - Visual stress, binocular instability
  - Treatment may help symptoms but will not cure dyslexia
- People with reading difficulties & symptoms can be referred to interested eyecare practitioners via www.s4clp.org

Society for Coloured Lens Prescribers

www.s4clp.org

Use supporting organisations

S4CLP: set up in 2007 for prescribers of precision tinted lenses who sign up to a code of conduct about:
- Relevant training - 10 hrs in last 5 yrs
- Equipment - for BV & PTL
- Evidence-based practice
- List is publicised to teachers, educational psychologists, parents
- International Institute of Colorimetry: promotes colorimetry, organises CET & conferences

www.colorimetryinstitute.org

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