Overview of visual factors relating to reading difficulties

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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

Overview of LD & SpLD

Profund learning disabilities (PLD): usually low IQ & disabilities in several academic areas
- e.g., Downs 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

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

Optims do not treat dyslexia

The term “visual dyslexia” is a misnomer

Visual problems may contribute to reading difficulties
- In these cases visual treatments may help
**PLAN**

INTRODUCTION

CONVENTIONAL OPTOMETRIC CORRELATES

MAGNO (TRANSIENT) VISUAL DEFICIT

BEHAVIORAL OPTOMETRY

SENSORY VISUAL STRESS

CONCLUSIONS

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

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

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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

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**ALIGNING PRISM:** Mallett Unit

- aligning prisms/spheres to eliminate FD
- good foveal and peripheral fusion lock
- question set is important
- ask if a line ever moves

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**SUMMARY:** DIAGNOSIS

- Can be measured with:
  - Loose prisms
  - Prism bar
  - Rotary prisms

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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, but improved academic behaviour with VT (Bonring et al., 2012)

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 |

EBP is “the integration of best research evidence with clinical expertise and patient values.” (Sackett, 2000)


Do base in prisms work? – depends on test used

| 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 |
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Evans (2007) yes
Scheiman & Gwiazda (2011) no

Conc: controversial

PLAN

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BEHAVIORAL OPTOMETRY

SENSORY VISUAL STRESS

CONCLUSIONS

Magno & parvo sub-systems (Transient and sustained)

| magno system is predominance |
| parvo system is predominance |
| rapid | slow |
| low acuity | high acuity |
| low contrast | high contrast |
| colour insensitive | colour sensitive |

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

Dyslexia: linking the visual deficits (a)

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

Log Flicker Threshold

Vergence Amplitude
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

The magno deficit in dyslexia: the take-home message for clinicians

- The magno deficit is unlikely to be a major cause of dyslexia and may even be a consequence of dyslexia
- Optometrists do not routinely test magno function (except maybe FDT test)
- No validated treatments for the magno deficit
- Magno deficit not directly linked to visual stress

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

“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 DSM-5 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 (Medland 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-06)
- “Reynolds et al. (2003) provides no evidence that DDAT is an effective form of treatment” (Snowling & Hulme, 2003)
Is vision therapy for saccades effective?

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

EBP is "the integration of best research evidence with clinical expertise and patient values."
Key research on sensory visual stress (SVS) with the “Intuitive” system

- PTL can alleviate symptoms when reading
  Wilkins, Evans, Busby et al. (1994)

- Overlays associated with improved speed of reading
  Wilkins et al. (1996); Bouldoukian, Wilkins (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)

- The benefit from PTL is linked to pattern glare
  Evans, Wilkins, Busby et al. (1995); Scott et al. (2002)

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
  Lightstone, Lightstone, Wilkins (1999)

- VS appears to be about 2-3x more common in dyslexic children than non-dyslexic
  Kriss & Evans (2003); Evans & Allen (2016)

- Delphi study proposed diagnostic criteria
  Evans, Allen, Wilkins (2017)

Pitfalls in researching VS

- Research the target condition
  Menacker et al. (1992) & Henderson et al. (2012) researched dyslexics
  Mitchell et al. (2008) did not study people with VS

- Mitchell et al. (2008) did not study people with VS
  Bouldoukian et al. (2002) studied participants who “reported relief from overlays”
  Ritchie et al. (2011) used an ab initio diagnostic process which found VS in 77% of poor readers

- Prescribe colour individually, allowing for a degree of precision
  Menacker et al. (1992) & Ritchie et al. (2011) 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 WRRT 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

Sensory visual stress

PREVALENCE: uncertain, >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

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

1a. Systematic review of homogenous RCTs
1b. Individual RCT with good CI
2a. Systematic review of homogenous cohort studies, confirming evidence
2b. Individual cohort study
3a. Systematic review of case control studies
3b. Individual case control study
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“Not a simple integration of best research evidence with clinical expertise and patient values” (Bailey, 2000)
Comparison of main systems

<table>
<thead>
<tr>
<th>Feature</th>
<th>Intuitive Colorimeter</th>
<th>Idea</th>
</tr>
</thead>
<tbody>
<tr>
<td>Screening</td>
<td>Pattern glare test,</td>
<td>Overlays</td>
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<tr>
<td></td>
<td>overlays</td>
<td></td>
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<tr>
<td>Testing: ability to</td>
<td>Very large range of</td>
<td>Very large range of</td>
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<td>find optimal tint</td>
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<td>Validation</td>
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<td>Reading Test</td>
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<td>Availability of contact</td>
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<tr>
<td>Meet SASC 2018 guidelines</td>
<td>Yes</td>
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<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, RawiEz, Chromagen, Photostimtech
Unproven techniques: Optoprocessimeter & Orthoscoptics

PLAN

INTRODUCTION

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BEHAVIORAL OPTOMETRY

SENSORY VISUAL STRESS

CONCLUSIONS

Conclusions

- A minority of patients with reading difficulties report visual symptoms:
  - Does text start clear & then move or blur?

- If symptoms, suspect:
  - Sensory visual stress, binocular instability, accommodative insufficiency
  - Treatment may help symptoms but will not cure dyslexia

- People with reading difficulties & symptoms can be referred to interested ECPs via
  www.s4clp.org

- Openly discuss controversial nature of some treatments
  - May include (for SpLD): coloured filters, low plus bifocals, prism, vision therapy

Join 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.s4clp.org

www.colorimetryinstitute.org

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