A RANDOMISED CONTROLLED TRIAL OF LOW POWER PLUS LENSES FOR PRE-PRESBYOPES WITH DIGITAL EYESTRAIN

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Authors

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Role of the team:
Study design: Bruce Evans, Olga Prenat, Natalia Vlasak, Robert Yammouni
Data collection: Robert Yammouni
Data analysis: Robert Yammouni, Bruce Evans
Presentation: Bruce Evans

Acknowledgements/disclosure

Background

Digital eyestrain (DES) = computer vision syndrome
- Affects up to 40% of adults and 80% of teenagers
- For reviews see Rosenfield (2016), Sheppard and Wolffsohn (2018)
- Is DES a new problem or a rediscovery of an old problem (asthenopia)? Evans (2019)
- Asthenopia can be classified as internal and external Sheedy et al. (2003)
- The same classification applies to DES Gonzalez-Perez (2019)
- Accommodative support lenses have been designed to ease DES, typically providing +0.50DS to +1.25DS.

Test battery

<table>
<thead>
<tr>
<th>Category</th>
<th>Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visual</td>
<td>LogMAR on computerised LogMAR chart</td>
</tr>
<tr>
<td>Ocular</td>
<td>Fundus photography; fluorescein angiography</td>
</tr>
<tr>
<td>Motility</td>
<td>Pen torch in cardinal positions of gaze</td>
</tr>
<tr>
<td>Alignment</td>
<td>Cover test</td>
</tr>
<tr>
<td>Accommodation</td>
<td>RAF rule, MEM retinoscopy</td>
</tr>
</tbody>
</table>

Immediate effect of plus lenses

- Effect of plano (control), +0.50, +0.75, +1.25
- Also asked about subjective preference

Research question & design

- Are low power plus lenses helpful in DES?
- Cross-sectional study with a double-masked randomised controlled crossover investigation of the immediate effect of plus lenses

Participants, inclusion & exclusion criteria

1. Aged between 16 and 40 years;
2. Significant symptoms on viewing digital devices, defined as a CVS-Q score of 6 or more;
3. Processed over 1 hour a week viewing modern computer displays (e.g., desktop, laptop, tablet, smart phone);
4. No ocular pathology requiring referral to an ophthalmologist;
5. No unexplained poor visual acuity (worse than 6/9);
6. No recent onset incomitancy or strabismus;
7. No history of refractive surgery.

Plan

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Results
Conclusions

Bar graph shows a comparison of visual stress, head tilt, prismatic corrections, and autism with low refractive corrections, dry eye, and low dose atropine.

Image courtesy of Dr Mariano Gonzalez-Perez & Hoya

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Results – general descriptive

- 107 participants; 36% male
- Mean age 31y (SD 5.25, range 20-40y)
- Median PC use 8h a day
- No ocular pathology or poor VA

<table>
<thead>
<tr>
<th>Variable</th>
<th>Median (D)</th>
<th>IQR (D)</th>
<th>Range (D)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SER</td>
<td>-0.25</td>
<td>1.88</td>
<td>-7.00 to +3.00</td>
</tr>
<tr>
<td>LE</td>
<td>-0.25</td>
<td>1.88</td>
<td>-7.62 to +2.75</td>
</tr>
<tr>
<td>Cylinder</td>
<td>-0.25</td>
<td>0.50</td>
<td>-2.50 to 0.00</td>
</tr>
<tr>
<td>RE</td>
<td>-0.25</td>
<td>0.50</td>
<td>-2.75 to 0.00</td>
</tr>
<tr>
<td>LE</td>
<td>-0.25</td>
<td>0.50</td>
<td>-2.75 to 0.00</td>
</tr>
</tbody>
</table>

Which lens power was subjectively preferred?

- Data available for 84 participants
- 69% able to choose one option
- When could not choose, weighting system used
- Preferences
  - 20% control lens
  - 24% +0.50
  - 47% +0.75
  - 8% +1.25

Why +0.75D often preferred?

- Data available for 84 participants
- Not due to age
- Not explained by amplitude of accommodation
- Not explained by lag of accommodation (except for the 3 participants who chose +1.25)
- N.B., participants viewed text at normal VDU distance, ~40-110cm

Does the preferred lens give best performance?

- For the 58 participants who were able to decide on one lens, this was the lens giving best performance in 28% of cases
- Kendall correlation 0.71 (p=0.052)
- Including participants who ranked more than one lens as equal best, this agreed with best performance in 49% of cases
- Kendall correlation 0.36 (p=0.072)

Why fastest with +0.75D?

- Not due to age
- Not explained by amplitude of accommodation
- Not explained by lag of accommodation
- N.B., participants viewed text at normal VDU distance, ~40-110cm

How about dry eye?

- DEWS score max 36 (range: 9-27), no-one reached 50%
- SANDE score median 53 (IQR 31.00, range 1-90)
- Typical of a dry eye population (median 52; Amparo & Dana, 2018)
- Participants with the most severe dry eye symptoms perform worst at the WRRT
- Supports previous research (Hider et al., 2013; Ousler et al., 2015)
Is DES multi-factorial?

- Caution: multiple correlations

<table>
<thead>
<tr>
<th>Variable</th>
<th>CVS-Q</th>
<th>SANDE</th>
<th>DEWS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subjective refraction</td>
<td>-0.028</td>
<td>p=0.723</td>
<td>-0.040</td>
</tr>
<tr>
<td>WRRT</td>
<td>-0.102</td>
<td>p=0.128</td>
<td>-0.089</td>
</tr>
<tr>
<td>DES HRS</td>
<td>0.012</td>
<td>p=0.868</td>
<td>0.128</td>
</tr>
</tbody>
</table>

- Yes, of course!

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- 80% of people with DES prefer plus, most often +0.75
- +0.75 is also best for performance
- 51% read fastest with +0.75
- Correlation between preference and performance is modest (r = 0.36 to 0.71)
- The preference for +0.75 is not explained by age or accommodation; may be related to viewing distance
- Supports the application of low plus/accommodative support lenses for DES
- DES is multifactorial
- Dry eye also influences performance at WRRT