Eccentric Correction in CFL

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Central scotoma

- The largest group of partially sighted
- AMD; up to 30% of the population over 65 years
- Other retinal dysfunctions and opticusatrophy
- Central visual field loss = CFL

The eye’s optical system

- Is by nature optimized for central vision
- Normal eyes use peripheral vision for orientation and detection
- Do the aberrations influence eccentric vision when there is a total central scotoma?
- In peripheral optics oblique astigmatism is the major aberration
**Optical laboratory**

Double-pass method
- 20 emmetropic eyes
- Off-axis astigmatism and defocus
- On the nasal and temporal side, at 10-60° angle from the visual axis
- Variation among individuals is up to 10 D

**PowerRefractor**

- Photorefraction
- Developed in Tübingen, Germany
- Measures refraction in both eyes
- Fixation angle
- Eccentric refraction in oblique angles to about 30°
Ring target acuity

- High-pass Resolution Perimetry
- Dr. Lars Frisen, ophthalmologist, Göteborg, Sweden
- Special test HRP
- Contrast 90%, shown as single flash

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High-pass Resolution

Contrast sensitivity

- Pelli-Robson chart
- Log contrast sensitivity, LCS
- Easy to use
- One meter test distance
Central and Eccentric Correction

Central correction = Rx

Eccentric correction = Rx

Results

From a selection of 38 cases with CFL
- Seven were given eccentric correction
- Five showed improvements in ring target acuity (HRP)
- Five had improved contrast sensitivity, LCS
## Central and Eccentric Correction

<table>
<thead>
<tr>
<th>Subjects</th>
<th>Eye</th>
<th>Central correction</th>
<th>Eccentric fixation angle</th>
<th>Eccentric correction</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>O.D.</td>
<td>+2.0 –1.0 x 25°</td>
<td>30° to the right</td>
<td>+4.0 –4.0 x 90°</td>
</tr>
<tr>
<td>2</td>
<td>O.S.</td>
<td>–3.75</td>
<td>18° to the right</td>
<td>–2.0 –3.0 x 90°</td>
</tr>
<tr>
<td>3</td>
<td>O.D.</td>
<td>None</td>
<td>13° up</td>
<td>+3.0 –1.5 x 160°</td>
</tr>
<tr>
<td>4</td>
<td>O.D.</td>
<td>+2.0</td>
<td>20° to the right</td>
<td>+5.0 –5.0 x 90°</td>
</tr>
<tr>
<td>5</td>
<td>O.D.</td>
<td>–1.25</td>
<td>20° to the right and 8° up</td>
<td>–1.0 –4.0 x 90°</td>
</tr>
<tr>
<td>6</td>
<td>O.D.</td>
<td>None</td>
<td>22° to the right</td>
<td>–1.0 –2.0 x 80°</td>
</tr>
<tr>
<td>7</td>
<td>O.S.</td>
<td>–1.5</td>
<td>20° up</td>
<td>–1.0 –2.0 x 175°</td>
</tr>
</tbody>
</table>

## First subject

- **Large CFL for 30 years, male, born 1947**
- **Central correction**
  - O.D. +2.0 –1.0 x 25°
  - VA 0.02 (20/900)
- **Fixation 30° to right**
- **Eccentric correction**
  - O.D. +4.0 –4.0 x 90°
  - VA 0.03 (20/600)
Second subject

- Retinal degeneration, for 20 years, female, born 1943
- One fixation angle, 18° to the right
- Central correction
  O.S. -3.75  
  VA 0.05 (20/400)
- Eccentric correction
  O.S. -2.0 - 3.0 x 90°  
  VA 0.066 (20/300)

Aberrometry

- Wavefront sensing with Hartman-Shack aberrometer
- One subject evaluated
Central correction
sph. - 3.75 D

Eccentric fixation 18°
to the right with O.S.

Eccentric correction
sph. - 2  cyl. - 3 ax 90°

Eccentric fixation 18°
to the right with O.S.
Practical implications

• Better image quality at the PRL can probably reduce magnification need
• The result is an increased reading distance and larger visual field
• Better possibilities to find the most efficient PRL
• Development of training methods for CFL subjects are in progress

Conclusions

• Visual function can be significantly improved with eccentric correction of oblique astigmatism in five cases of CFL
• For subjects with one stable eccentric fixation angle and oblique astigmatism, spectacle correction can be used
• Further development of measurement methods is needed
• More experimental corrections