Binocular vision & contact lenses

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PLAN

BACKGROUND

INDICATIONS

CONTRA-INDICATIONS

CONCLUSIONS

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Why are contact lenses (CL) good for orthoptic function?

- Dissociated deviation
- Compensated or not

Why are CL better than specs for sensory fusion?

- Visual field:
  - More natural in CL than spectacles
  - Clear field of vision is larger with CL
- Peripheral fusion:
  - Plays key role in normal binocular vision
    (Burian, 1939)
  - Fixation disparity smallest with central combined with peripheral fusion lock
    (Ukwade, 2000)
- With anisometropia, in addition to above:
  - Reduced differential prismatic effects
  - Reduced aniseikonia

DISCLOSURE

- Paid lectures & KOL/product feedback programmes:
- Lecture content always my own
- Author of Pickwell’s Binocular Vision Anomalies, editions 3-5
- 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

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Orthoptic indications for contact lenses

- Sensory orthoptic benefits from contact lenses
  - Anisometropia
  - Aiding central suppression through blur suppression
- Motor orthoptic benefits from contact lenses (improving ocular alignment)
  - Enhancing fusion through wider field of clear vision
  - Accommodative esotropia
- Other orthoptic benefits from contact lenses
  - Nystagmus
  - Occlusive contact lenses in intractable diplopia

The death of Knapp’s law

- Winn et al. (1988) disproved Knapp’s law:
  - CL minimise anisokoria in axial as well as refractive anisometropia
  - In young patients, CL provide a more potent binocular stimulus to the visual system
- Romano & von Noorden (1999)
  - “Knapp’s law may be optically right but clinically wrong”
  - “Such patients may benefit from CL”
- Kramer et al. (1999)
  - Reduction in retinal element density in high myopia limits the applicability of Knapp’s law
- Kitaguchi et al. (2007)
  - The cone mosaic is more spaced out in myopia

Anisometropia & CL: a pioneer’s view

- Edwards (1979)
  - “CL have numerous advantages in cases of high ametropia or anisometropia”
  - Reduce distortion, aberrations, prismatic effects away from primary position
  - Only disadvantage may be unequal retinal image sizes in axial anisometropia [Knapp’s law]
  - But hypothesis that there may be different receptor spacing

Anisometropia

- Anisometropia is prevalent
  - 1.5% of Caucasians have ≥2D aniso
  - 13.5% of Europeans have ≥1D aniso
  - 7% of Asian children have ≥1D aniso
- Amblyopic children improve on average by 2.5 lines of VA from spectacles alone; 22% need no patching
- The conventional sensitive period does not apply to orthotropic anisometropic amblyopia
  - See: Cobb et al, 2002; Evans et al., 2011

F8303: Miss L, clinical data

| Description | 16 year old female |
| History | Specs since age 5y, patching, no strab.
| Refractive findings | R+3.00=6/15- L-0.50=6/6- |
| Orthoptic findings | D=ortho N=4Δ XOP |
| Date fitted with CL | Sept 2003 |
| Fitted with | R Air Optix Night & Day +3.75 |
| Date last follow-up | 9/2/2004 |

F8303: Miss L, n-of-1 study

| Before CL | After CL |
| Symptoms | None | No probs |
| Unaided vision | 6/20+ | 6/15- |
| Correction worn | None worn | 6/17 CW |
| Corrected VA | R 6/15- | R 6/10- |
| Cover test | D=No move | D=No move |
| Stereo-acuity | Global: +50 Global: +25 |
| Contoured: 20° | Contoured: 20° |
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Case study: 6883

Description: 46 year old male
Healthcare professional & sailer

History: Subtle torsional diplopia
Neuro-ophthalmologist attributed to ocular myasthenia gravis, good prognosis but no Tx

Refractive findings:
- R: -0.75/-0.25x10
- L: -0.75/-0.50x10
- D: +1.50
- 5-10° extorsion, worse in elevation

Orthoptic findings:
- Dr: N 1
- A: R hyperphoria, G1 RSO UA
- 5-10° extorsion, worse in elevation

CL fitting (2006):
- Monovision, RE DV. 6/5, N4, no diplopia.

Fitted with:
- Biofinity/Oasys CW, now Oasys one day

Date last follow-up:
- April 2018. No symptoms. BV stable.

Ocular motor triad with single vision contact lenses compared to spectacle lenses

Olivia A. Hunt,1*, James S. Wolfssohn*, Carlos García-Rosía2

- Theoretically, myopes have to converge & accommodate more in CL than specs: hyperopes vice versa
- Hunt et al (2006) of SCL with specs in myopes & hyperopes:
  - Compared 30 participants aged 18-25y, ±0.0 to ±3.50
  - Theoretical calculations are correct in direction, but may underestimate the magnitude of the difference in accommodative response
  - Large inter-individual variations
Jimenez et al. (2011) compared scleral contact lenses (SCL) with spectacles in myopes. More eso (less exo) with SCL was associated with insufficiency and convergence excess. Other findings were not significant.

Minimal effects of SCL on binocular vision (BV) and accommodation and most patients were likely to adapt.

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**Motor factors: convergence insufficiency of dry eye**
- Asthenopic symptoms can be attributable to external (e.g., dry eye) and internal (e.g., binocular vision anomalies) factors
- Convergence Insufficiency Symptom Survey is very similar to Ocular Surface Disease Index
- Symptoms of discomfort with contact lenses could be from binocular vision anomalies

**Motor factors: correcting deviations**
- Refractive accommodative esotropia (fully attributable to hypermetropia) responds well to contact lenses (CL)
- Intermittent partially accommodative esotropia responds well to stepwise increases of hypermetropic prescription, blurring to 6/7.5

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G4313: Mr H

| Description:     | 46 year old male Amateur dramatics |
| History:         | High myopia & decompensating esophoria Eye exercises age 18-19y Ophthalmological opinion confirms prisms as option for now, maybe surgery later. |
| Refractive findings: | R-8.00/-0.50x160.33, out = 6/7.5 L-6.50/-0.50x37 Δ out = 9/7.5 |
| Orthoptic findings: | D-4-191 SOP N 4-151 SOP |
| Date fitted with CL: | March 2001 |
| Fitted with: | Igel 58 Rx toric prism Δ out each eye |
| Date last follow-up: | 7/11/1: findings similar with CL to specs |

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Early onset nystagmus

- Nystagmus prevalence 0.1% Harris (2013)
- 1st RCT: Jansen-Richardson et al (2014)
- No significant effect on vision or nystagmus
- BUT:

<table>
<thead>
<tr>
<th>With RGP</th>
<th>With SCL</th>
</tr>
</thead>
<tbody>
<tr>
<td>40%</td>
<td>say CL better than specs 50%</td>
</tr>
<tr>
<td>55%</td>
<td>say about the same 50%</td>
</tr>
<tr>
<td>5%</td>
<td>say CL worse than specs 20%</td>
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Did not look for subgroups

Early onset nystagmus (cont.)

- Prospective case series Bagheri et al (2017)
- 16 participants, SER +1.00 to +6.25
- Fitted rigid gas permeable contact lenses (RGP)
- Significant improvements in VA (binocularly by 0.06 LogMAR)
- CSF (low & medium SFs), eye movements
- Pilot RCT Theodorou et al (2018)
- 27 adults completed trial (38 started)
- At 2 weeks, binocular VA improved by 0.06 LogMAR
- Eye movements also improved

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Intractable diplopia

- Case series indicates Scotogenic contact lens may be helpful in intractable diplopia Robert et al (2015)
- Opaque contact lenses can be effective for treating intractable diplopia Newsam et al (2018)
Orthoptic contra-indications for CL

- Avoid monovision if prone to decompensate
- Decompensating heterophoria
- Strabismus
- Neurogenic incomitancy
- Avoid alternating vision

Contact lenses are indicated for many orthoptic problems, especially anisometropia. Carefully check orthoptic function before fitting contact lenses.

Orthoptic anomalies are present in 5% of primary eyecare patients. Good orthoptic function benefits from clear images, equal image size, and full field of view. Contact lenses are indicated for many orthoptic problems, especially anisometropia. Carefully check orthoptic function before fitting contact lenses.