Spectacles & contact lenses (CL): visual function disorders when contact lenses are indicated in preference to spectacles

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PLAN

BACKGROUND

INDICATIONS

CONTRA-INDICATIONS

CONCLUSIONS

DISCLOSURE

- Paid lectures/ KOL/product feedback/research funding:
  - 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

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

DISASSOCIATED DEVIATION

\[ \text{motor fusion} \rightarrow \text{sensory fusion lock} \]

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 (Burtan, 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

Literature review: results

- Contact lenses work well in unilateral high myopia
  - Flick (1979); Roberts & Adams (2002); Nilagiri et al. (2018)
- CL reduce BV problems in longstanding asymmetric keratoconus
  - Sherafat et al. (2001)
**Advantages of contact lenses in high refractive errors**

- More natural image size
  - Myopes suffer from minification with spectacles
  - Hyperopes may benefit from magnification with spectacles
- More natural field of view
  - Myopes have expanded field of view through spectacles
  - Hyperopes have reduced field of view with spectacles
- Frames that are not rimless cause a field loss
- Off-axis aberrations occur with spectacle lenses
  - Can still occur with contact lenses if poorly centred

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**Orthoptic indications for contact lenses**

- Sensory orthoptic benefits from contact lenses
  - Myopes suffer from minification with spectacles
  - Hyperopes may benefit from magnification with spectacles
- Motor orthoptic benefits from contact lenses (improving ocular alignment)
  - Enhancing fusion through wider field of clear vision
  - Accommodative esotropia
  - Prisms
- Other orthoptic benefits from contact lenses
  - Nystagmus
  - Occlusive contact lenses in intractable diplopia

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**The death of Knapp’s law**

- Winn et al. (1988) disproved Knapp’s law:
  - CL minimise aniseikonia 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

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**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
  - Simmons et al., 1999; Mintz-Hittner & Fernandez, 2000; Gold et al., 2002; Evans et al., 2011

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**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 hypothesises that there may be different receptor spacing

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**The conventional sensitive period does not apply to orthotropic anisometropic amblyopia**

- Logen et al. (2004)
- Walther et al. (2014)
- Hu et al. (2016)
**F8303: Miss L, clinical data**

- **Description:** 15 year old female
- **History:** Specs since age 6y, patching, no strab.
- **Refractive findings:**
  - R+3.00=6/15-
  - L-0.50=6/6-
- **Orthoptic findings:**
  - D=ortho N=4, 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**

<table>
<thead>
<tr>
<th>Before CL</th>
<th>After CL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symptoms</td>
<td>None</td>
</tr>
<tr>
<td>Unaided vision</td>
<td>6/20+</td>
</tr>
<tr>
<td>Correction worn</td>
<td>None worn</td>
</tr>
<tr>
<td>Corrected VA</td>
<td>R 6/15-</td>
</tr>
<tr>
<td>Cover test</td>
<td>D=N=no movem.</td>
</tr>
</tbody>
</table>

**Anisometropia & CL: practical aspects**

- Often need high plus lenses, so oxygen supply relevant
- Daily disposable silicone hydrogels are a good option
- Optimal clarity is the goal, so toric lenses often needed
- Continuous wear increases risk of MK [Bullimore et al., 2013]
- For daily wear, risk of complications from contact lenses is lower than for older people [Bullimore 2018]

**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
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- Other orthoptic benefits from contact lenses
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  - Occlusive contact lenses in intractable diplopia

**Case study: 6883**

- **Description:** 46 year old male
  - Healthcare professional & sailor
- **History:** Subtle torsional diplopia
  - Neuro-ophthalmologist attributed to ocular myasthenia gravis, good prognosis but no Tx.
- **Refractive findings:**
  - R-0.75/-0.25x10 6/5  Add+1.50
  - L-0.75/-0.50x170 6/5  Add+1.50
- **Orthoptic findings:**
  - D=N 10° 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.
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Motor orthoptic benefits from contact lenses (improving ocular alignment)

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Contact lenses vs spectacles in myopes: is there any difference in accommodative and binocular function?

- Jimenez et al. (2011) of soft contact lenses (SCL) with specs in myopes:
  - Higher accommodative lag (0.25-0.50D) with SCL
  - Near phoria +1.25D more eso (less eso) with SCL
  - Near divergent fusional reserves lower with SCL
  - Negative relative accommodation higher with SCL
  - Uncommonly measured, but can be associated with accommodative insufficiency and convergence excess
  - Other findings not significant
  - Minimal effects of SCL on BV and accommodation and most patients likely to adapt
  - Advisable to check heterophoria before fitting contact lenses and, if significant, check compensation

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Motor factors: CL may provide a better fusion lock

- The wider field of clear binocular vision with contact lenses may improve the fusion lock

G7992: Miss C.

- Age 17, -3.00 DS each eye
- Referred to me because large exophoria at distance and near that has been decompensating for years
- Various exercises keep episodes of diplopia "barely tolerable"
- Phobic about surgery & could not tolerate over-minus
- With soft daily CL significantly less diplopia than with spectacles
- Important to fully correct myopia
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Motor factors: correcting deviations

- Refractive accommodative esotropia (fully attributable to hypermetropia) responds well to CL
- Intermittent partially accommodative esotropia responds well to stepwise increases of hypermetropic prescription, blurring to 6/7.5

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/-0.50 x 160 Δ out = 6/7.5
L -8.50/-0.50 x 37 3Δ out = 6/7.5

Orthoptic findings:
D 4-19.5 SOP N 4-15Δ SOP

Date fitted with CL:
March 2001

Fitted with:
Iveg 58 Rx topical prism 2Δ out each eye

Date last follow-up:
7/11/1: findings similar with CL to specs

Early onset nystagmus

- Nystagmus prevalence 0.1%  
  Harris (2013)
- 5 case reports & case series say CL improve nystagmus & visual acuity
- 1st RCT:
  - No significant effect on vision or nystagmus
  - BUT:
    - With RGP
      - 40% say CL better than specs
      - 55% say about the same
      - 10% say CL worse than specs
    - With SCL
      - 40% say CL better than specs
      - 55% say about the same
      - 10% say CL worse than specs
  - 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
- Opaque contact lenses can be effective for treating intractable diplopia

**Orthoptic contra-indications for CL**

- Avoid monovision if prone to decompensation
  - Decompensating heterophoria
  - Strabismus
  - Neurogenic incomitancy
- Avoid alternating vision bifocals in superior oblique palsy

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

- Good binocular visual function benefits from clear images, equal image size, and full field of view
- Contact lenses are indicated for many refractive and orthoptic problems, especially anisometropia
- Carefully check orthoptic function before fitting contact lenses
  - Careful cover testing and, when there is a significant deviation, Mallett fixation disparity test & fusional reserves

Full handout from: www.bruce-evans.co.uk