



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

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 Reference: Pickwell's Binocular Vision Anomalies, 5th Edition,
 Elsevier, 2007



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INDICATIONS

CONTRA-INDICATIONS

CONCLUSIONS



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DISCLOSURE


- Paid lectures/ KOL/product feedback/research funding:
 - Alcon, American Academy of Optometry (UK), Association of Optometrists, Birmingham Focus on Blindness, Black & Lizars, Central (LOC) Fund, Cerium Visual Technologies, College of Optometrists, Coopervision, ESRC, General Optical Council, Hoya, Institute of Optometry, Iris Fund for Prevention of Blindness, Johnson & Johnson, Leightons, London Vision RSinic, MRC, Norville, Optos, Paul Hamlyn Trust, Perceptive, Scrivens, Specsavers, Thomas Pocklington Trust.
 - 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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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)



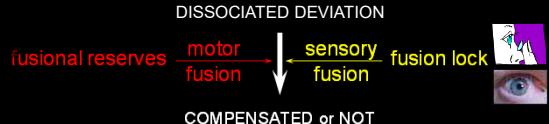

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Why are contact lenses (CL) good for orthoptic function?

DISSOCIATED DEVIATION

fusional reserves $\xrightarrow{\text{motor fusion}}$ \downarrow $\xleftarrow{\text{sensory fusion}}$ fusion lock

COMPENSATED or NOT

Available online at www.sciencedirect.com
 ScienceDirect
 Elsevier
 Orthoptic indications for contact lens wear
 Bruce J.W. Evans

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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

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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

Keirl & Christie (2007)

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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
 - Prisms
- ✦ Other orthoptic benefits from contact lenses
 - Nystagmus
 - Occlusive contact lenses in intractable diplopia

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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

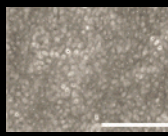
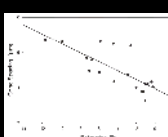




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The death of Knapp's law

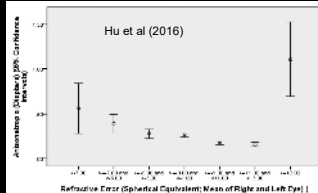
- ✦ Winn et al. (1988) disproved Knapp's law:
 - CL minimise aniseikonia in axial as well as refractive anisometropia
 - In young patients, CL provide a more potent binocular stimulus to the visual system
- ✦ Romano & von Noorden (1999)
 - "Knapp's law may be optically right but clinically wrong"
 - "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 $\geq 2D$ aniso Logan et al (2004)
 - 13.5% of Europeans have $>1D$ aniso Wolfram et al (2014)
 - 7% of Asian children have $>1D$ aniso Hu et al (2016)
- ✦ Amblyopic children improve on average by 2.5 lines of VA from spectacles alone; 22% need no patching Stewart et al. (2004)
- ✦ The conventional sensitive period does not apply to orthotropic anisometropic amblyopia Sen, 1982; Hardman Lea et al, 1989; Wick et al, 1992; Flynn et al, 1998; Simmers et al, 1999; Mintz-Hittner & Fernandez, 2000; Cobb et al, 2002; Evans et al., 2011



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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=4Δ XOP
Date fitted with CL:	Sept 2003
Fitted with:	R Air Optix Night & Day +3.75
Date last follow-up:	9/2/2004

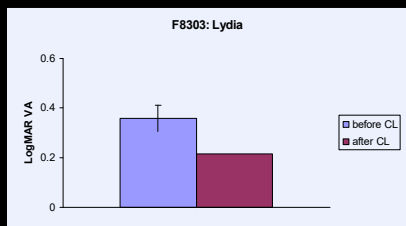
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F8303: Miss L, n-of-1 study

	Before CL	After CL
Symptoms:	None	No probs
Unaided vision:	6/20+	
Correction worn:	None worn	6/7 CW
Corrected VA:	R 6/15-	R 6/10-
Cover test:	D=N=no movem.	D=N=no movem.
Stereo-acuity:	Global: 500" Contoured: 20"	Global: 250" Contoured: 20"

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F8303: Miss L, N-of-one analysis



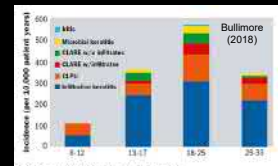
Crawford J.R., Garthwaite, P.H. Investigation of the single case in neuropsychology: confidence limits on the abnormality of test scores and test score differences. *Neuropsychologia* 40 (8):1196-1208, 2002.

t = -2.967, p=0.041

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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) and is perhaps a last resort
- For daily wear, risk of complications from contact lenses is lower than for older people (Bullimore 2018)



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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
 - Prisms
- Other orthoptic benefits from contact lenses
 - Nystagmus
 - Occlusive contact lenses in intractable diplopia

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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 1Δ 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.



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Orthoptic indications for contact lenses

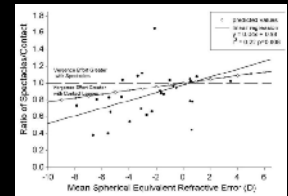
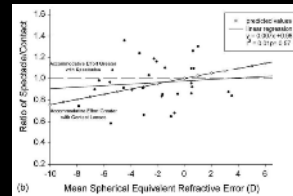
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Ocular motor triad with single vision contact lenses compared to spectacle lenses

Olivia A. Hunt^{a,b}, James S. Wolfsohn^a, Carlos Garcia-Resia^b

- Theoretically, myopes have to converge & accommodate more in CL than specs; hyperopes vice versa
- Hunt et al (2006) of SCL with specs in myopes:
 - Compared 30 participants aged 18-25y, -8.00 to +3.50
 - Theoretical calculations are correct in direction, but may underestimate the magnitude of the difference in accommodative response
 - Large inter-individual variations



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

Unpublished Arch Clin Exp Ophthalmol 2011; 49:925-935

Raimundo Jiménez · Lareto Martínez-Almeida · Carlos Salas · Carolina Ortiz

- 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*-2.5Δ more eso (less exo) 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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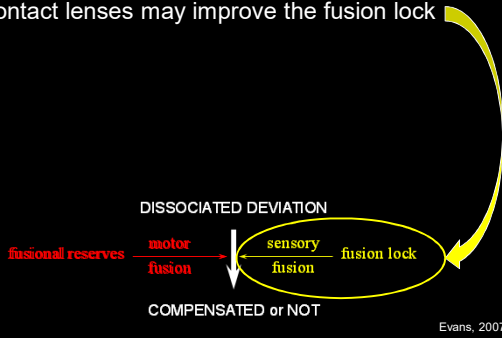
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Motor factors: CL may provide a better fusion lock

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



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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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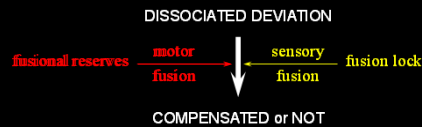
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Motor factors: correcting deviations

- 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

Abdi et al (2016)



Evans, 2007

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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 3Δ out = 6/7.5 L -8.50/-0.50x37 3Δ out = 6/7.5
Orthoptic findings:	D 4-19Δ SOP N 4-15Δ SOP
Date fitted with CL:	March 2001
Fitted with:	Igel 58 Rx toric prism 2Δ out each eye
Date last follow-up:	7/11/1: findings similar with CL to specs

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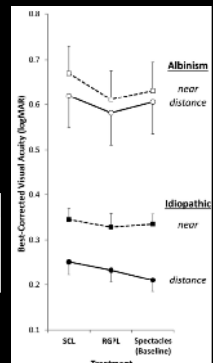
Early onset nystagmus

- Nystagmus prevalence 0.1% Harris (2013)
- 5 case reports & case series say CL improve nystagmus & visual acuity
Abadi (1979); Dell'Osso et al (1988); Matsubayashi et al (1992); Biousse et al (2002); Rutner & Cluffreda (2005)

- 1st RCT: Jayaramachandran et al (2014)
 - No significant effect on vision or nystagmus
 - BUT:

With RGP	With SCL
40% say CL better than specs	30%
55% say about the same	50%
5% say CL worse than specs	20%

- Did not look for subgroups



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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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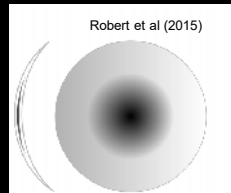
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Intractable diplopia

- 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 Newsham et al (2018)



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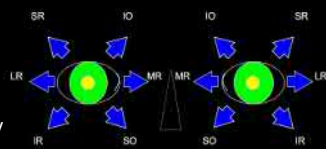
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Orthoptic contra-indications for CL


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



Video clip source: CD-ROM in Evans (2007)
Pickwell's Binocular Vision Anomalies, 5th edition

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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

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Full handout of slides from www.bruce-evans.co.uk

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