CATARACT SURGERY AND DIPLOPIA

G 20/20 MEETING BRISBANE 2014

Lionel Kowal, RVEEH /CERA, Melbourne
DISCLAIMERS

▪ Everything in this talk is distorted by selection bias
▪ I don’t do cataract surgery and I don’t see the happy pts ...I see a small Array of problem pts
▪ I won’t talk about monocular diplopia eg through PI
# Diplopia after Cataract Surgery

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<th>‘New’ reasons: Normal or near-normal muscle function: usually ≥1 ‘minor’ stresses on sensory &amp; motor fusion</th>
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‘Old’ reasons: Marcaine toxicity can be any muscle, usu IR, esp. LIR

- Day 1: LIR paresis: left hyper, restricted L depression, diplopia: everyone anxious ≤1%
- Day 7-10: diplopia goes: everyone happy
- Week 2+: LIR fibrosis begins - diplopia returns: left hypo, restricted L elevation: everyone upset 0.1-0.2%
- Hardly ever gets better

Spontaneous recovery from inferior rectus contracture (consecutive hypotropia) following local anesthetic injury.
Typical combination for 6ml retrobulbar block
2.2 ml 2% mepivicaine, 3.8 ml 0.75% bupivicaine, 0.25 ml 1.0% epinephrine, 150 U hyaluronidase.

3-fold greater number of L c.f. R eyes (p< .005).

Insignificant (p> 0.2) increase during hyaluronidase shortage.

<table>
<thead>
<tr>
<th>Category</th>
<th>Total number</th>
<th>Diplopia Number</th>
<th>Diplopia %, fraction</th>
</tr>
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<tbody>
<tr>
<td>All eyes</td>
<td>17,531</td>
<td>32</td>
<td>0.18, 1/555</td>
</tr>
<tr>
<td>Topical</td>
<td>3,817</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Retrobulbar</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All</td>
<td>13,714</td>
<td>32</td>
<td>0.23%, 1/430</td>
</tr>
<tr>
<td>One surgeon</td>
<td>7,410</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Other R/B mostly anesthetists</td>
<td>6,304</td>
<td>32</td>
<td>0.51%, 1/196</td>
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Damage starts <2h

From Alan Scott
5 days after BP Human [Rainen]
MARCAINE TOXICITY
TREATMENT OPTIONS

- Prisms: $\Delta$s often effective (often small angles)
- Botox: might work but $n=0$
- Surgery: esp if $\geq 10\Delta$

LK: topical, adjust on-the-table, ceiling target for diplopia, non-absorbable suture
- High success rate
MARCAINE TOXICITY AVOIDANCE

- If you add an EMG monitor to your injecting needle, whether you think you are doing a R/B or P/Bulbar, you are IN the inf rectus ~50% of the time
- Avoid R/B & P/B blocks if your problem rate is >1/200
- No reason to believe that xylocaine should be less toxic, but no reports on xylocaine toxicity, prob because used very little [but is my preference]

Only one case report in literature following sub Tenons block
- Diplopia following sub-tenon's anaesthesia: an unusual complication.
EOM MARCAINE TOXICITY:
NEW APPLICATION: INCREASE THE STRENGTH OF THE UNDERACTING MUSCLE IN STRABISMUS

Bupivacaine Injection Remodels Extraocular Muscles and Corrects Comitant Strabismus

Joel M. Miller, PhD,1 Alan B. Scott, MD,2 Kenneth K. Danh, BS,2 Dirk Strasser, BSS,2 Mona Sane, MD2

Ophthalmology 2013;120:2733-2740
BILATERAL CATARACTS, HISTORY OF AMBYOPIA, ± TROPIA: WHICH EYE FIRST?

- Surgery on amblyopic eye 1st runs a risk of fixation – switch diplopia

- Cataract surgery planning in amblyopic patients--which eye first? Awareness of the potential for post-operative diplopia amongst consultant ophthalmic surgeons in Wales. Samuel Williams G, Radwan M, Menon J.


75% of ophthalmologists had encountered amblyopic patients who had developed problems after cataract surgery .... awareness of post-cataract surgery diplopia, and in particular fixation switch diplopia, is not widespread amongst consultant ophthalmic surgeons in Wales
## Diplopia after Cataract Surgery

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2 VERY IMPORTANT QS

1. How much anisometropia is it safe to ‘correct’ [reduce] with IOLs?

2. How much anisometropia is it safe to introduce with IOLs in order to give monovision MV?
Case 1: A Case of Aniseikonia Due to “Sensible” Cataract Surgery

- 56 yo Dr for R phaco/IOL
- Pre-op refractions (SE)
  - R -8 D  L -2.5 D
- Post-op refractions (SE)
  - R +0.25 D (6/8)  L -2.5 D (6/6)
- Constant Diplopia
  - XT 8 Δ, LHT 8 Δ - presumably this was all asymptomatic phoria before cataract surgery
CAUGHT “KNAPPING”?
AXIAL ANISOMETROPIA DOESN’T USU CAUSE ANEISOKONIA

- If Axial anisometropia is converted to corneal or lenticular anisometropia, then aniseikonia is to be expected.
- Aniseikonia will impair motor and sensory fusion and predispose to diplopia [esp if there is also a hitherto trivial motor phoria].
- Axial lengths = R 29.48 mm L 26.75 mm
- Now has 13% R macropsia

Likely to have been anticipated by pre-op CL testing
- Galilean telescope system has resolved diplopia by minimising RE image : + CL, with equivalent - to spectacle lens.
MEASURING ANISEIKONIA 1

• Look @ 6/60 E

• Which one is bigger? BDΔR, R sees higher image

• Does it look like an ‘E’ should? [metamorphopsia]

• Is the ‘E’ tilted? [detect torsion]

• If a bar of the ‘E’ is worth 20%, how much bigger is it?

Also check with BD prism in front of other eye - prisms can also cause magnification
Use R-G glasses.

Find the pair of semi-circles where the difference in size compensates for the patient’s aniseikonia
MEASURING ANISEIKONIA 3
MOST ‘REAL LIFE’ WAY:
SIZE LENSES UP TO ±13%
...the success rate for CL-induced MV varies from 50 – 76% 

...refractive surgery MV, .... patient satisfaction rate ranging from 72-96% 

...a significant rate of non-success
SURGICAL / PERMANENT MV ≠ INTERMITTENT / TEMPORARY MV

- 3 month MV [e.g. early PRK days] : rare minor deficit in binocularity
- Lasik MV ➔ reduced binocular vision in 20%


- 3 patients with Pseudophakic MV IOLs who developed ET with diplopia ≥2 y after IOLs

Rx: Reverse the MV

Pollard et al Am J Ophthal 2011

This paper also contained examples of CL MV causing diplopia
HOW MUCH ANISOMETROPIA IS IT SAFE TO:

1. REDUCE?

2. INTRODUCE?

1. Evidence based:

Reduce: no evidence

Introduce: Refractive surgery cohort: 1.8 DS too much; ~20% will have symptoms of abn binocular vision.

No universally accepted criteria for IOL-MV.

Common: Full distance Rx to dominant eye.
[Dominant: hole- in- card to VEP].

Some ‘cross MV’ – opposite approach. Some ignore dominance.

Introduced anisometropia 1 to 2.5 DS
HOW MUCH ANISOMETROPIA IS IT SAFE TO:
1. REDUCE?
2. INTRODUCE?

- 2. Eminence based: ..introduce / reduce as little as possible.
- Every time you do reduce or introduce anisometropia you many satisfied pts BUT there is an unknown [?] low % of problem patients, and the % probably increases with time after surgery.
‘EXTREME MONOVISION’ (3-5 DS) TO TREAT DIPLOPIA

- 9/12 pts: a myopic defocus of at least 3 D was achieved, which resolved the preexisting diplopia.
- 3/12 pts: the achieved myopic defocus was −2D to −3D, the diplopia symptoms were diminished but occasionally evident.
- All patients achieved excellent UDVA and UNVA
- No patient reported being dissatisfied.
- None of these pts were offered strabismus surgery
CASE 2: SMALL VERTICALS: A NEWLY RECOGNISED MECHANISM FOR DIPLOPIA IN THE ELDERLY: SAGGY EYE MUSCLES

- 82 yo  Intermittent Horizontal diplopia, mainly on left gaze, since cataract surgery 4 yrs ago
- R 6/9, L 6/6

**Horizontal Deviation:**

<table>
<thead>
<tr>
<th>0</th>
<th>6ET</th>
<th>12ET</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>6ET</td>
<td></td>
</tr>
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Small L hypo in primary

- Prescribed glasses:

  8Δ BO, 2Δ BU LE ➜ single vision
Sagging of LLR pulley
some atrophy of LSR – LLR band
‘better’ SR – LR tissue sling

Not directly related to cataract surgery, but happens in same age group and will be attributed by patients to cataract surgery
Degeneration of the LR-SR band may occur in elderly

Inferior displacement of the LR Pulley.

LR is now a less capable abduction, & now has an infraduction vector as well

ET & Hypotropia


Similar in 1) JAMA Ophthalmol. Published online March 7, 2013. doi:10.1001/jamaophthalmol.2013.783  2) AJNR, Published April 24, 2014 as 10.3174/ajnr.A3943
CASE 3: DIPLOPIA FOLLOWING "ROUTINE" CATARACT SURGERY

- 70 yo F
- High myope
- H diplopia after 1\textsuperscript{st} cataract surgery
- ‘It’s because of the imbalance - will be better after 2\textsuperscript{nd} eye is done’
2nd Eye Cataract Surgery 1w Later

- Diplopia same... 2nd image now clearer.
- Symptoms dismissed [again] – 'It’ll get better'
- 2nd ophthalmologist: ..you’re 6/6 OU...looks great ... I’m a cataract surgeon....

If you can’t understand a pt’s symptoms, it doesn’t mean they are not there...or not important
CASE 3: HEMIANOPIA:

- If it’s bad enough to cause loss of fusion = retinal slip, field loss won’t be subtle and will be detectable on confrontation to movement of or counting fingers, losing $\frac{1}{2}$ a vision chart

...large pituitary tumour removed a few weeks later
Modern macular treatments preserve acuity but do not prevent metamorphopsia & aniseikonia.

Can be occult until vision improving surgery.
You don’t have to examine your pts in great detail: Sensory causes nearly all diagnosable on history

Ask every patient with post cataract diplopia that is not IR fibrosis:
Is the image seen by the R:
- Larger / smaller than the one seen by the L
- Same shape as L
- Paler / darker than L
- Tilted [torsion]
- Final Q: Does it wobble? Heiman Bielschowsky, Sup Obl Myokymia, HororFusionis, Oculo palatal myoclonus,…

All of these are barriers to fusion
OPTICAL SOLUTIONS TO IN-/DE-CREASE IMAGE SIZE & RESOLVE DIPLOPIA

- Increase front base curve
- Increase central thickness
- Decrease BVD ( - lens)
- Increase refractive index
- ‘Thick’ lenses
  Special Order
  Lenses we prescribe are always ‘thin’ lenses
- Prisms

...often successful!
HIGH RISK #1: BEWARE CORRECTING / ‘IMPROVING’ ANISOMETROPIA

- Spectacles compensate for most cases of aniseikonia 2° to axial anisometropia BETTER than do IOLs or corneal refractive surgery

- Converting R: -12, L: -4 to -2 DS OU runs a real risk of PRODUCING aniseikonia, abnormal binocular vision and permanent troublesome diplopia esp if there is a small hitherto asymptomatic &unrecognised phoria

- NO prospective studies to guide us how to handle anisometropic pts having IOLs
HIGH RISK #2: BEWARE OF MONOVISION

There are no prospective studies that can tell us which pts are safe for IOL Monovision.

You need to tell MV pts that there is a small risk [%?] of problems that seem to be fixable by reversing the MV.

Sometimes these problems can present 2-3 y after surgery.

In one prospective refractive surgery planned MV study, pts with abnormal binocular vision had anisometropia av. 1.8DS, normal Binocular Vision 0.5DS [p<0.001]
HIGH RISK #3: BEWARE MACULAR MEMBRANES

- Metamorphopsia / aniseikonia can be beyond the ability of optical devices to resolve.
- Cataract surgery can cause permanent diplopia in these pts.
THANK YOU & GOOD LUCK

How good are you at achieving your targets for your patients?
CHANGING EXTRAOCULAR MUSCLE (EOM) BIOMECHANICAL PROPERTIES

Surgery Botox (BT) Bupivacaine (BP)

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<tr>
<th></th>
<th>Size</th>
<th>Strength</th>
<th>Stiffness</th>
<th>Length</th>
<th>Tension</th>
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India Feb. 2012
BP injection in animals:

VOLUMES & CROSS-SECTIONAL AREA

- Pre-Injection, post-Injection, and follow-up scans track changes in muscle volume.

- Crossection analysis shows location of injection bolus (■), and pattern of regrowth (■, ■, ■).
BP TREATMENT OF STRABISMUS:

- Probably useful for 10-12Δ horizontal strabismus
- ?place in ptosis treatment
2nd Eye Cataract Surgery 1w Later

- Diplopia same...2nd image now clearer.
- Symptoms dismissed [again] – it’ll get better
- 2nd ophthalmologist: ..you’re 6/6 OU...looks great ... I’m a cataract surgeon....

If you ignore a pt’s symptoms, they don’t go way.
Diplopia following "routine" cataract surgery: Motor and sensory causes

- Motor cause – in days of blocks, were common in a strabismus practice; now very rare
- All types / variations of motor causes usually easily recognised EXCEPT torsional diplopia: you have to ask the pt: is the 2nd image tilted?
- If pt doesn’t behave like the typical IR palsy- then- fibrosis : Image
- Occult Graves’ an irregular surprise
AAO PREFERRED PRACTICE PATTERN

ASCRS survey (USA)
- 2003: 86% of surgeons preferred MV, 13% preferred multifocal IOL
- 2007: MV 61%, multifocal IOL 17.5%.

New Zealand
- 2004: MV preferred by 81%.
- 2007: MV 50%, multifocal IOL 31%

Though decreasing, MV is still a common surgical approach to spectacle independence
February 2011
Feature
• How Far Will Femtosecond Go?
• 32 IOL Questions
Clinical Insights
• Sentinel Lymph Node Biopsy

Feature
Spotlight on IOL Complications

(PDF 1,319 KB)

Case 2: Cataract Patient Hates Glasses

Q6 In general, what strategy do you most commonly recommend for cataract patients who hate glasses?

Accommodating IOLs in both eyes 7%
Multifocal IOLs in both eyes 33%
Mix different multifocal IOLs 6%
Mix multifocal and accommodating IOLs 2%
Monofocal monovision 36%
Refer elsewhere for surgery 16%