

double vision
double vision
double vision
double vision
double vision
double vision

...AFTER CATARACT SURGERY

Lionel Kowal RVEEH Melbourne

תננו מאתך דעה בינה והשכל

DISTORTION



- Everything in my talk is distorted by **selection bias**
- I don't do cataract surgery. I don't see the numerous happy pts that you produce
- I see a small Array of pts with imperfect outcomes that may /not be due to the cataract surgery



DIPLOPIA AFTER CATARACT SURGERY

'Old' reasons	'New' reasons : Normal or near- normal muscle function: usually ≥ 1 'minor' stresses on sensory & motor fusion
Inf Rectus contracture after -- -caine damage	Anisometropia: Monovision & Aniseikonia
Other muscles damaged by -caine	Metamorphopsia 2ary to macular disease
Incidental 4ths and occult Graves' Ophthalmopathy uncovered by cataract surgery	Minor acquired motility changes of the elderly: Sagging eye muscles
<u>Old, Rare & largely forgotten</u> Amblyopia: fixation switch Hiemann Bielschowsky	Other sensory issues: Big difference in contrast between images, large field defects.



'OLD' REASONS : -CAINE TOXICITY
IS IT A PERI- OR RETRO- BULBAR?

- If you add an EMG monitor to your injecting needle, whether you think you are doing a Retro- or Peri- Bulbar, you are IN the inf rectus $\sim \frac{1}{2}$ of the time*

**Elsas, Scott*



'OLD' REASONS : -CAINE TOXICITY

CAN BE ANY MUSCLE, USU IR, ESP. LIR

- Day 1: LIR paresis : left hyper, restricted L depression, diplopia : everyone **anxious** $\leq 1\%$
- Day 7-10: diplopia goes : everyone **happy**
- Week 2+: LIR fibrosis begins - diplopia returns : left hypo, vertical & torsional diplopia, 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.*

Sutherland S, Kowal L. *Binocul Vis Strabismus Q.* 2003;18(2):99-100.



SEMINAL ARTICLE ON RETROBULBAR BLOCKS

PERSISTENT VERTICAL BINOCULAR DIPLOPIA AFTER CATARACT SURGERY

D. A. JOHNSON

AM J OPHTHAL 12/2001

- Typical combination for retrobulbar block
mepivacaine, bupivacaine, epinephrine, hyaluronidase.
- **3-fold greater number of L c.f. R eyes** ($p < .005$).
- Insignificant ($p > 0.2$) increase with hyaluronidase shortage.

Category	Total number	<u>Diplopia</u> Number	<u>Diplopia</u> %, fraction
All eyes	17,531	32	0.18, 1/555
Topical	3,817	0	0
Retrobulbar			
All	13,714	32	0.23%, 1/430
One surgeon	7,410	0	0
Other R/B mostly anesthetists	6,304	32	0.51%, 1/196



RADIOLOGY OF - CAINE TOXICITY 1:

- Ann Fr Anesth Reanim.

2007 Nov;26(11):927-30.

- **Diplopia complicating peribulbar anesthesia for cataract surgery and early use of MRI.**

- Dupont M¹, Taylor G, Devys JM.

- Article in French - I have only viewed abstract



RADIOLOGY OF - CAINE TOXICITY 1 :

- 4805 pts with peribulbar for cataract surgery
- 8 had diplopia on day 1, all had urgent MRI
- 7/8 had a T2 hyper intensity signal within the paralysed muscle = inflammatory oedema following unintentional intra muscular injection of local anaesthetic‘

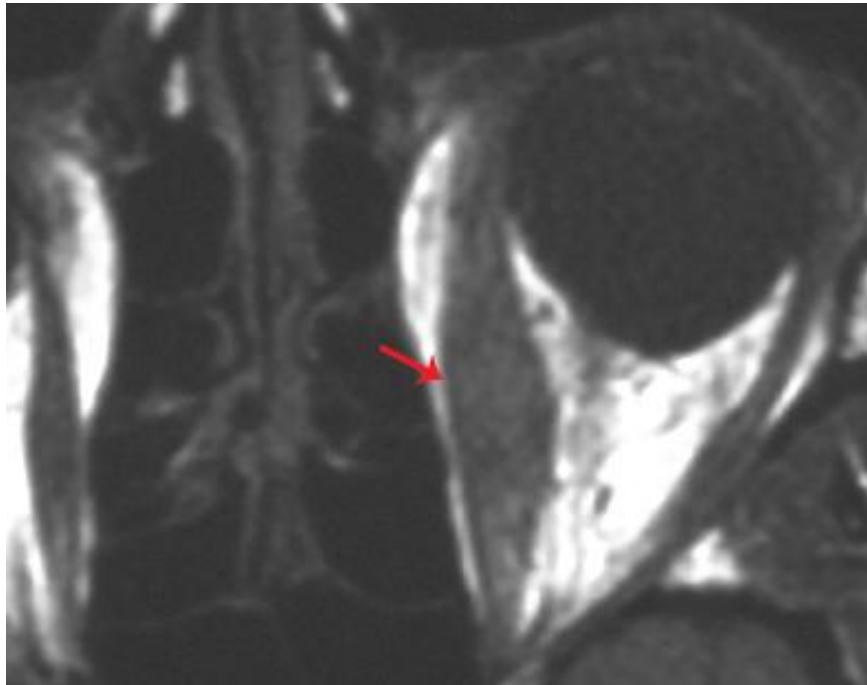


RADIOLOGY OF - CAINE TOXICITY 2:

EARLY : LOOKS LIKE ?TED

LATE: NEAR NORMAL

- LMR: 3 ml of 3% Bupivacaine
- Acute enlargement MR
- 7 months later
- Near- normal MR



These scans are with high % Marcaine – used to create muscle hypertrophy, not the 0.5-0.75% used for anesthesia



- CAINE TOXICITY

TREATMENT OPTIONS

- **Prisms : Δ s often effective** (often small angles)
- Botox: might work [Scott says 50%!]; my n=0
- **Surgery : esp if $\geq 10\Delta$**
- LK: topical, adjust on-the-table, ceiling target for diplopia, non-absorbable suture
- **High success rate**
- LK: Surgery 'n': used to be 1-2 a year. Last 4-5 years: 0.



ARE ALL –CAINES EQUALLY TOXIC ?..PROBABLY

- There are more bad reports about Bupivacaine than other –caines, possibly reflecting the frequency with which it is used
- When I need a block, I use just Lidocaine. There are no reports of Lidocaine-only muscle toxicity, possibly reflecting the relative infrequency with which Lidocaine-only is used



DIPLOPIA AFTER CATARACT SURGERY:

MOSTLY **SENSORY** CAUSES

‘Old’ reasons	‘New’ reasons : Normal or near- normal muscle function: usually ≥ 1 ‘minor’ stresses on sensory & motor fusion
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Other muscles damaged by Marcaine	Metamorphopsia 2ary to macular disease
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SENSORY CAUSES

NEARLY **ALL** DIAGNOSABLE ON HISTORY

**ASK EVERY PATIENT WITH POST
CATARACT DIPLOPIA :**

Is the image seen by the R:

- Larger / smaller than the one seen by the L**
- Same shape as L**
- Paler / darker than L**
- Do you have double vision only with R fixation, only with L fixation,...
[monocular diplopia, fixation switch diplopia]**



MOTOR CAUSES

NEARLY **ALL** DIAGNOSABLE ON HISTORY

**ASK EVERY PATIENT WITH POST
CATARACT DIPLOPIA**

- **IR fibrosis: operated eye sees higher image, & is tilted towards nose**
- [if vertical] **Does it go away when the head is flat e.g. lying down on your back? [Skew]**
- Tilted [torsion]
- Horizontal – see SES below
- **Final Q: Does it wobble?** Heimann Bielschowsky, Sup Obl Myokymia, Horor Fusionis, Oculo palatal myoclonus,...



ANISEIKONIA / ANISOMETROPIA / MACULA

3 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?
- 3. Can we treat aniseikonia [from, say, macular causes] by modifying IOL powers?



HIGH RISK:

**BEWARE CORRECTING / 'IMPROVING'
ANISOMETROPIA.**

SOME OF THIS IS COUNTER-INTUITIVE

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



HIGH RISK:

BEWARE CORRECTING / 'IMPROVING' ANISOMETROPIA.

SOME OF THIS IS COUNTER-INTUITIVE

- Converting R: -12, L: -4 to -2 DS OU runs a **real risk of PRODUCING aniseikonia**, Abnormal Binocular Vision ABV* & 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**
- *ABV:*
- *binocular blur, discomfort, diplopia - improved by closing one eye*



CAUGHT “KNAPPING”? *

AXIAL ANISOMETROPIA DOESN'T USU CAUSE ANEISOKONIA

- **If Axial anisometropia is converted to lenticular anisometropia, then aniseikonia is to be expected**
- Aniseikonia will impair motor & 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 – **explains 6.5DS of anisometropia**
- 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

**Thank you Logan Mitchell*



A SIMPLE FAIRLY ACCURATE WAY TO DETECT AND MEASURE ANISEIKONIA

- Look @ 6/60 E
- Which one is bigger? $BD\Delta R$, 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 & confirm with BD prism in front of other eye - prisms can cause magnification



3 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?***
- 3. Can we treat aniseikonia [from, say, macular causes] by modifying IOL powers?

**MEH: MonoVision vs MultiFocal IOLs*

MF IOL better visual outcome, higher exchange rate



SURGICAL / PERMANENT MV ≠ INTERMITTENT / TEMPORARY MV 1

- Temporary MV:

3 month MV [e.g. early PRK days] :
rare minor deficit in binocularity

- Lasik MV → reduced binocular vision in 20%

Kowal L, De Faber J, Calcutt C, Fawcett S. 'Refractive surgery and strabismus' (Workshop in 'Progress in Strabismology').

In: de Faber JT, ed. Proceedings of the 9th Meeting of the International Strabismological Association, Sydney, Australia.



SURGICAL / PERMANENT MV

≠ INTERMITTENT / TEMPORARY MV 2

**○ 3 patients with IOL MV
developed ET with diplopia
≥2 y after surgery**

○ Rx: Reverse the MV worked in all

Pollard et al Am J Ophthal 2011

November 2016 update from Pollard

About 50% of the pts present 2+ yrs after IOL MV

About 50% are fixed by reversing the MV [usu with
glasses] -



HOW MUCH ANISOMETROPIA IS IT SAFE TO:

1. REDUCE?
2. INTRODUCE ?

○ 1. Evidence based:

Reduce: no evidence

Introduce: Refractive surgery cohort: **1.8 DS is too much**. ~20% will have symptoms of abn binocular vision [diplopia / blur/ discomfort fixed by closing one eye]

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.

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 have a lot of evidence of early pt satisfaction

BUT

- **there is an unknown [?] low % of problem patients, and the % probably increases with time after surgery.**

Increases with time:

- ?progressive deterioration of fusion because of MV
- ?other aging changes that further damage fusion



3 VERY IMPORTANT QS

- 1. How much anisometropia is it safe to **'correct'** [reduce] with IOLs?
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- 3. **Can we treat aniseikonia** [from, say, macular causes] **by modifying IOL powers?**



CASE 2: 65 YO MECHANICAL ENGINEER!

COMPETITION TABLE TENNIS.

~**25% MICROPSIA** AFTER RET DET SURGERY :
CATARACT SURGERY PROPOSED

- 2yrs ago noticed transient vertical diplopia after prolonged near work
- 6 mo ago: **R retinal detachment.**
- VA **R 20/200. -2 : 20/125. Dense nuclear cataract.**

Potential acuity [Haag Streit retinometer] 20/35.

- VA **L +1.25 20/30.**
- He estimates **~25% R micropsia.**

The most I can measure with Size lenses is 13%, and he estimates an extra 10%.



CASE 2: 65 YO MECHANICAL ENGINEER!

COMPETITION TABLE TENNIS.

~25% MICROPSIA AFTER RET DET SURGERY :
CATARACT SURGERY PROPOSED

- **R macular membrane**... some corrugations resemble choroidal folds.
- For distance [20/400 E]: **crossed diplopia of 4[^]; @**
~1m he has crossed diplopia 1[^].
- Within 0.5m & with near glasses **he has weak sensory fusion** fuses a polarised 4 dot test, Fly and 1/9 Titmus circles.

Blurred vision, anisometropia and large retinal aniseikonia: a usually trivial exodeviation of 1-4[^] is now symptomatic.

The retinal aniseikonia is not expected to go away



10 M



GOOD LEFT
EYE

RIGHT (BLURR & SMALLER)
EYE

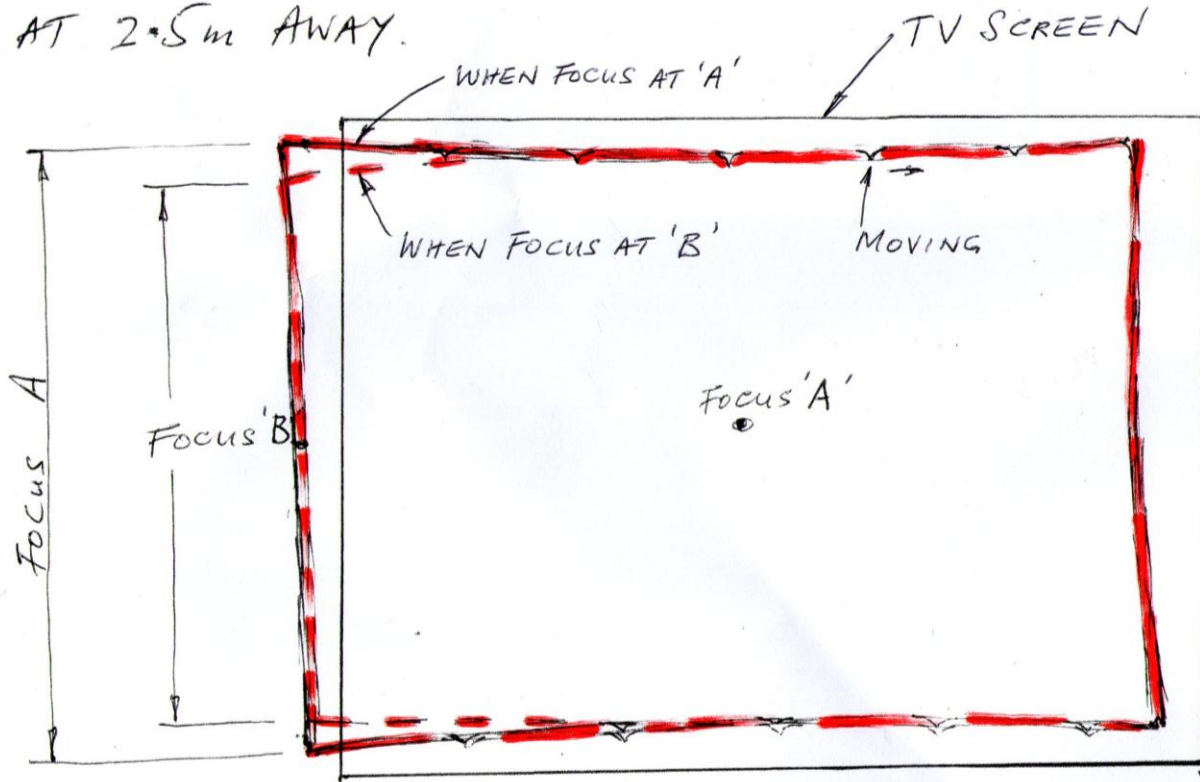
FERN LEAF
10 m. AWAY

EC 2011



2.5M

TV SCREEN 420 V x 550 H
AT 2.5m AWAY.

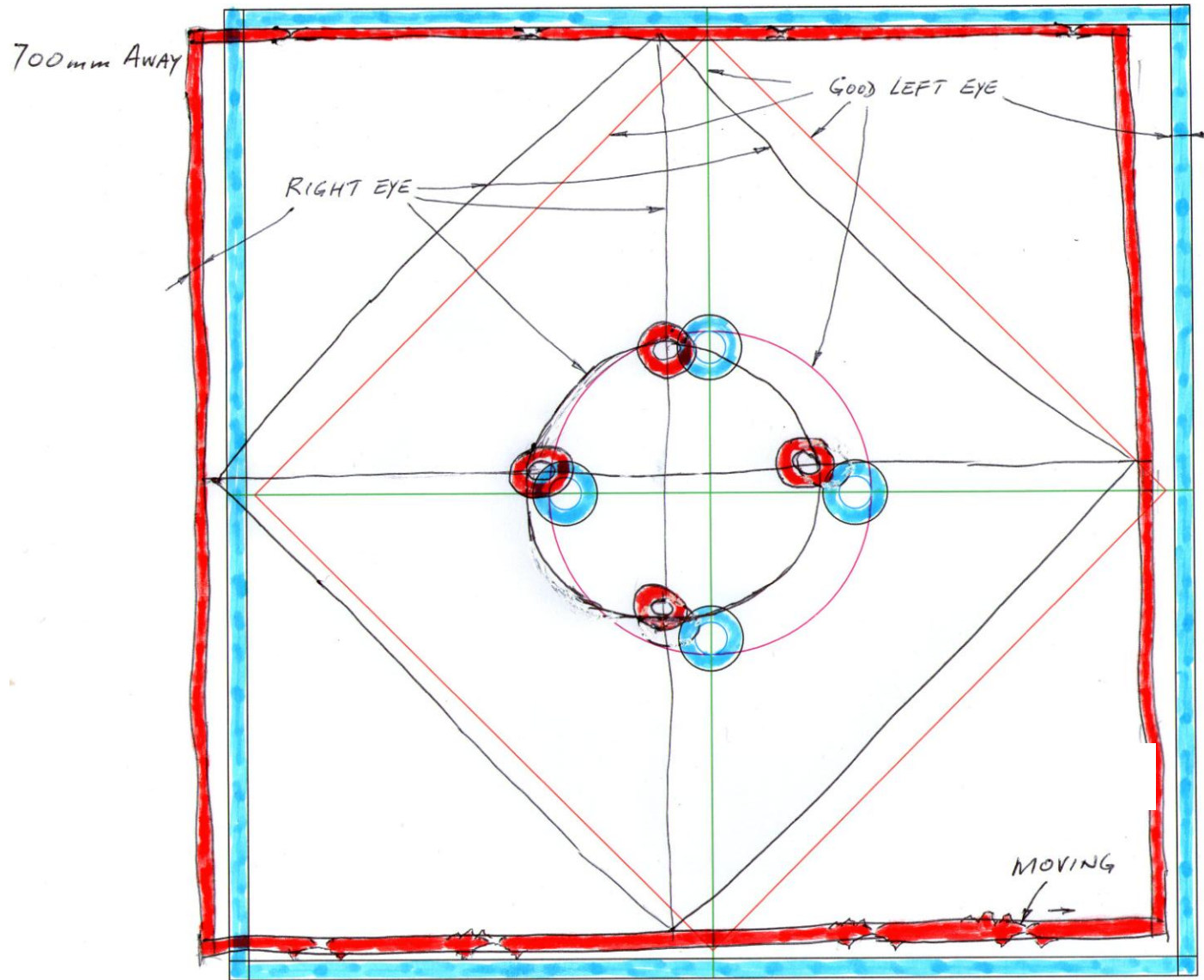


RIGHT EYE VISION **(IN RED)**

- LINES ILL DEFINED.
- LINE BECOMES SHORTER WHEN FOCUS ON OR MOVES TO.
- COLOUR IS OKAY.



0.7M



GAS BUBBLE
VANISHED
ON 16 DEC 2011
INTRODUCED
ON 5 OCT 2011.



VK
17/12/2011

OPINION FROM DR. DE WIT, 'THE' WORLD ANISEIKONIA GURU NB: HE IS A PHYSICIST – DOESN'T TREAT PATIENTS

HOW TO RESOLVE RETINAL ANISOKONIA WITH CHOICE OF IOL POWER & SPECTACLE LENS

- Combining the large amount of 25% and the retinal detachment, the aniseikonia/micropsia is most likely field dependent, i.e. it varies across the retina and at larger angles in general the aniseikonia seems to be less.

Detailed explanation of how to compensate for his aniseikonia

image that cannot be optically corrected. The patient should therefore not expect to regain a similar comfort in binocular vision as before the retinal detachment. This being said, there are patients that do benefit from having a certain amount of aniseikonia being corrected. The 25% cannot realistically be corrected, but this 25% is probably only totally in the center of vision at very small field angles



HOW TO THEORETICALLY RESOLVE RETINAL ANISEIKONIA WITH CHOICE OF IOL POWER

IOL refraction aim

- +1.25 in spectacle plane: 6% aniseikonia correction
- +3 in spectacle plane: 10% aniseikonia correction
- **Choose IOL power that leaves +4.75 to be corrected in the spectacle plane: 14% aniseikonia correction**
- *Intellectually elegant workup was ignored by the cataract surgeon, left him emmetropicwith a great outcome!*
- 4y later: 6/6 sc OU. No aniseikonia. Some metamorphopsia when tested monocularly. Resumed competitive table tennis



HIGH RISK #2 :

BEWARE MACULAR MEMBRANES

- Metamorphopsia / aniseikonia can be beyond the ability of optical devices to resolve in some pts
- Cataract surgery can cause permanent diplopia in some of these pts
- ***Metamorphopsia / aniseikonia that is intolerable in some pts causes no problems in others***



IOL AFTER LONG STANDING MONOCULAR APHAKIA

- If you can demonstrate some fusion with loose prisms or synoptophore, no diplopia or fixable diplopia after IOL

- Ahn YJ et al. Graefes Arch Clin Exp Ophthal 2016
- Khan A, BJO, 2008



DIPLOPIA AFTER CATARACT SURGERY

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CASE 3: DIPLOPIA FOLLOWING "ROUTINE" CATARACT SURGERY

- 70 yo F
- High myope
- H diplopia after 1st cataract surgery
- 'It's because of the imbalance - will be better after 2nd 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



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



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CASE 4:

SMALL ESO +/- VERTICAL IN A HEALTHY 82 YO

- **Sagging eye muscles**
- Only recently recognised: this is probably the commonest cause / mechanism for small angle diplopia in the elderly



CASE 4: SMALL ESO +/- VERTICAL:

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

Horizontal Deviation:

0 0
0 ← 6ET → 12ET *looks like partial L 6th*
 6ET

Small L hypo in primary

- Prescribed glasses:
8Δ BO, 2Δ BU LE → single vision





Small abduction deficits

SAGGING EYE SYNDROME SES

Image size: 512 x 512

View size: 1141 x 635

WL: 355 WW: 710

X: 165 px Y: 368 px Value: 372.00

X: -44.11 mm Y: -69.73 mm Z: -65.18 mm

S

072571 (83 y , 83 y)

Orbits - Exclude Patholo - Cor T1 (Thin)

27408

8

'better' SR - LR
band

some atrophy of
LSR - LLR band

710

355

0

LA

**Sagging of LLR :
LLR vector now
different:
ET +/- small hypo
with diplopia**

Zoom: 270% Angle: 0

Im: 5/24_A (A -> P)

TE: 14.512 TR: 440

FS: 1.5

**Not directly related to cataract surgery, but happens in same age group
and will be attributed by patients to cataract surgery**

PS: not rare, but few radiologists know about it

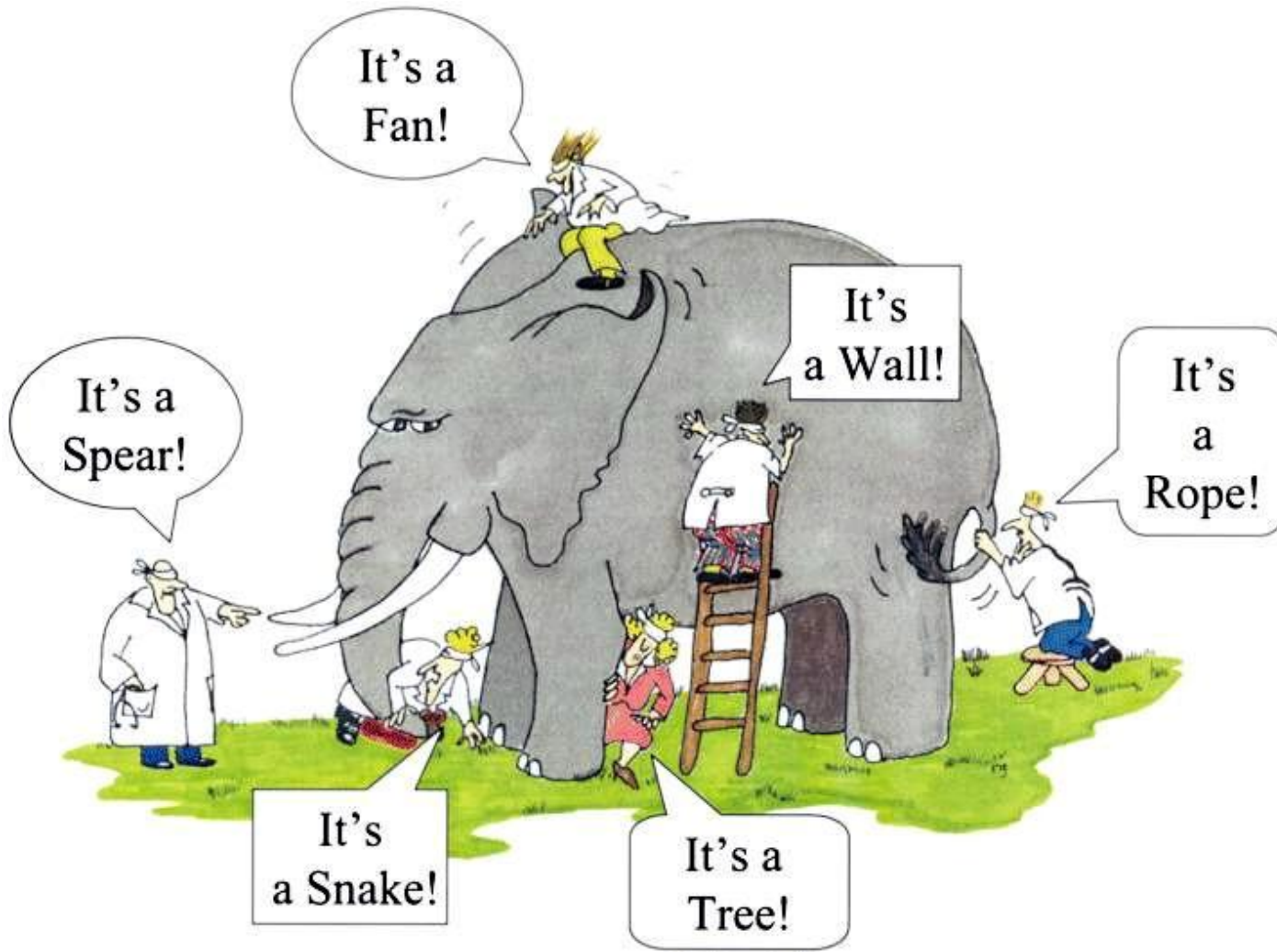
PAP: PROSTAGLANDIN ASSOCIATED
PERIORBITOPATHY – RECOGNISED BY
OCULOPLASTICS AND GLAUCOMA DR

SES: SAGGING EYE SYNDROME -
RECOGNISED BY STRABISMUS DR



SAGGING EYE MUSCLES SES & PROSTAGLANDIN ASSOC PERIORBITOPATHY PAP

○ PAPER IS PROBABLY A CAUSE OF SES



Some descriptions of PAP include diplopia: Are these cases of SES?

THE BLIND MEN & THE ELEPHANT

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AMBLYOPIA: BE CAREFUL

DO NOT PRODUCE FIXATION SWITCH DIPLOPIA

- With treated/untreated strabismus and unilateral amblyopia, there is usually a suppression scotoma in one eye.
- If the eye with the suppression scotoma is made sensorially dominant, there is no suppression scotoma available in the previously dominant eye, and if there is even a tiny strabismus, the pt may have **fixation switch diplopia**
- **Do cataract surgery on the habitually dominant eye first**



ULSTER MED J. 2013 MAY;82(2):82-4.

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.

- 32/42 consultants responded to the survey (>75%).
- **24/32 (75%) had encountered amblyopic patients who had developed problems after cataract surgery**

Which eye first?

- 18 (56%): cataract surgery first on the non-amblyopic eye
- 11 (34%): amblyopic eye first
- 3 (9%): patient preference dictates the choice regarding which eye is operated first.



LONG STANDING MONOCULAR CATARACT

...or cataract in a pt with long standing acquired visual loss for another reason

- LOOK FOR SLOW VERTICAL OSCILLATION, typically $\sim 1\text{Hz}$
- = Heimann Bielschowsky Phenomenon
- VERY UNDER-RECOGNISED
- **All get vertical postop diplopia**

Aust N Z J Ophthalmol. 1998 Aug;26(3):237-40.

The Heimann-Bielschowsky phenomenon: dissociated vertical nystagmus.

Davey K, Kowal L, Friling R, Georgievski Z, Sandbach J.



THANK YOU & GOOD LUCK
WITH YOUR PATIENTS

