

www.optometriam2018.it

OPTOMETRIA 2018

Heterotropia (strabismus): diagnosis, classification, investigation

Prof Bruce Evans
BSc (Hons) PhD FCOptom FAAO FEAEO FBCLA DipCLP DipOrth
Director of Research Institute of Optometry
Visiting Professor City, University of London
Visiting Professor London South Bank University
Private practice Cole Martin Tregaskis, Brentwood, Essex
© 1990-2018 Bruce Evans

DISCLOSURE

- Paid lectures & KOL/product feedback programmes:
 - Alcon, American Academy of Optometry (UK), Association of Optometrists, Birmingham Focus on Blindness, Black & Lizards, Central (LOC) Fund, Cerium Visual Technologies, College of Optometrists, Coopension, ESRC, General Optical Council, Hoya, Institute of Optometry, International Institute for Colorimetry, Iris Fund for Prevention of Blindness, Johnson & Johnson, Leightons, London Vision Clinic, 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

For regular tweets on optometric research:
Follow @BruceJWEvans

PLAN

- INTRODUCTION
- INVESTIGATION OF INCOMITANCY
- IIINVESTIGATION OF HETEROTROPIA
- CONCLUSIONS

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

For regular tweets on optometric research:
Follow @BruceJWEvans

PLAN

- INTRODUCTION
- INVESTIGATION OF INCOMITANCY
- INVESTIGATION OF HETEROTROPIA
- CONCLUSIONS

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

OVERVIEW: CAVEAT

- >5% of patients seeing community optometrists have BV problems
- Always look for pathology:
 - Neuro-optometric checks
 - Pupils, discs, fields, strabismus, incomitancy, accommodation
 - Check these things regularly
- Don't forget refraction
- Change management if not improving significantly
- Refer if still not improving
- Appropriate re-exam intervals (frequent)

Classification

comitant-----incomitant

```

  graph TD
    Deviation --- Heterophoria
    Deviation --- Strabismus
    Heterophoria --- H1[compensated/decompensated]
    Heterophoria --- H2[testing distance far/inter./near]
    Heterophoria --- H3[direction of deviation exo/eso/hyper]
    Strabismus --- S1[constancy constant/intermittent]
    Strabismus --- S2[test distance far/inter./near]
    Strabismus --- S3[sensory adaptation HARC/suppression]
    Strabismus --- S4[laterality unilateral/alternating]
    Strabismus --- S5[direction exo/eso/hyper/hypo]
  
```

PLAN

For regular tweets on optometric research:

Follow @BruceJWEvans

INTRODUCTION

INVESTIGATION OF INCOMITANCY

INVESTIGATION OF HETEROTROPIA

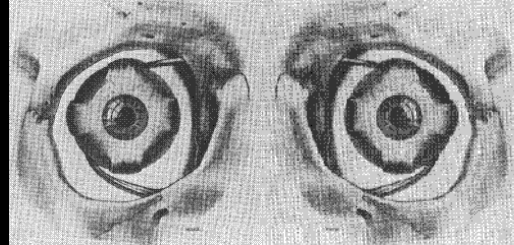
CONCLUSIONS



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



The extra-ocular muscles



CAUSES OF INCOMITANCIES

VASCULAR

- Diabetes
- Hypertension
- Stroke
- Aneurysms
- Temporal arteritis

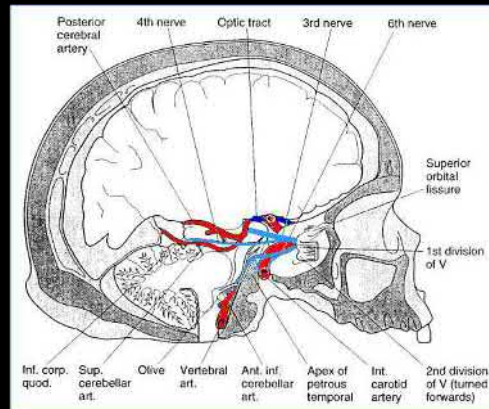
NEUROLOGICAL

- Tumours
- Multiple sclerosis
- Myasthenia gravis
- Migraine

OTHER

- Trauma
- Thyrotoxicosis
- Toxic
- Iatrogenic
- Idiopathic

Underlined = more likely in elderly



www.cuh.edu.com CA Hospital 251

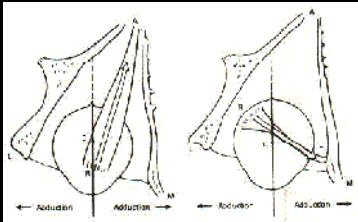
H. J. SIMPSON
M 19-23-98
CA Hospital 251

Image courtesy of John O'Donnell

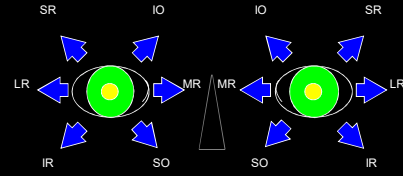
Motility test

- Use reliable pen torch
 - Check nose not occluding
- Really, three tests, so do three times:
 - 1) Observe corneal reflexes
 - 2) Cover test in peripheral gaze
 - 3) Ask about diplopia
- Beware of reports of diplopia
 - May break down (in view of target, distance, fus. res.)
 - May be variable
 - May be confused
- Know the muscle actions
 - Secondary actions of cyclovertical muscles: RADSIN (Recti Aduct; Superiors Intort)

ACTIONS OF SUPERIOR MUSCLES



MOTILITY DIAGRAM



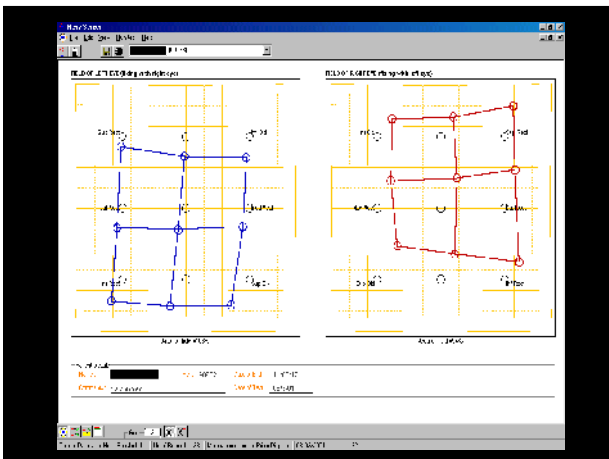
Max. vertical diplopia for RSO palsy

- In any vertical deviation, look carefully for SO underaction
 - In SR palsies, look carefully at SO in contralateral eye
 - Reports of vertical diplopia may be unexpected
- Do tests of cyclo-torsion
 - But may not be measurable in congenital cases

	31%		6%
	27%		3%
	21%		0.5%
	11%		



von Noorden et al (1986); from 270 cases



Neurogenic v. mechanical palsies

Feature	Neurogenic	Mechanical
Underaction during motility	Gradually apparent	Abruptly apparent
Secondary sequelae	Apparent (unless new)	Absent
IOP in gaze positions	Similar	Increases in restriction
Saccadic velocities	Slow	Close to normal

Incomitancies: conclusions

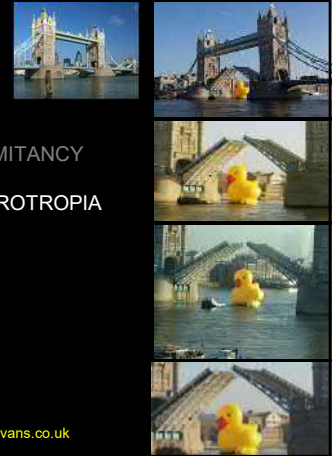
- Some incomitancies are difficult to detect
 - If symptoms are suspicious, do cover testing in peripheral gaze
 - Testing for cyclo-deviations detects SO palsies
- Refer new or changing incomitancies
- In some long-standing cases, prescribing the prism required in the primary position may help

PLAN

- INTRODUCTION
- INVESTIGATION OF INCOMITANCY
- INVESTIGATION OF HETEROTROPIA
- CONCLUSIONS



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



DIPLOPIA



a large degree of double vision

a small degree of double vision

Drugs and diplopia

- Alves et al (2015)
- Suspect drug interaction if diplopia occurs shortly after starting new drug

Drug	Why common (1/1000)
Hydroxyzine	Why common (1/1000)
Edrophonium	Common (1/1000 to 1/2000)
Botulinum toxin	Common (1/1000 to 1/100)
Sulfonamide	Common (1/1000 to 1/100)
Propranolol	Common (1/1000 to 1/100)
Neostigmine	Common (1/1000 to 1/100)
Tetracycline	Common (1/1000 to 1/100)
Sildenafil	Common (1/1000 to 1/100)
Clonidine	Common (1/1000 to 1/100)
Tropamide	Common (1/1000 to 1/100)
Zinc	Uncommon (1/10000 to 1/1000)
Acetylcholinesterase	Uncommon (1/10000 to 1/1000)
Baclofen	Uncommon (1/10000 to 1/1000)
Antidiplopia	Uncommon (1/10000 to 1/1000)
Adiphenidol	Uncommon (1/10000 to 1/1000)
Phenylephrine	Uncommon (1/10000 to 1/1000)
Demerol	Uncommon (1/10000 to 1/1000)
Carbamazepine	Uncommon (1/10000 to 1/1000)
Tetracycline	Rare (1/100000 to 1/10000)
Neostigmine	Rare (1/100000 to 1/10000)
Neostigmine/mestinon	Rare (1/100000 to 1/10000)
Quinine	Rare (1/100000 to 1/10000)
Sertraline	Rare (1/100000 to 1/10000)
Giprofloracin	Rare (1/100000 to 1/10000)

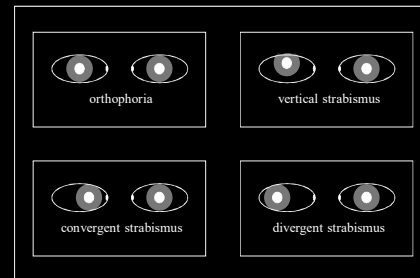
DISSOCIATED HETEROPHORIA

fusional reserves → motor fusion → sensory fusion → fusion lock

NOT COMPENSATED

STRABISMUS

Cover test in strabismus



FUSIONAL RESERVES

Can be measured with:

loose prisms



prism bar



rotary prisms



Fusional reserves

- Measure the fusional reserve that opposes the phoria first

Rosenfield et al (1995)

- Often the blur point cannot be measured

Horwood & Toor (2014)



Stereotests

- Lang works well with infants: look at eye movements
- Frisby makes a good game with squeaky toy
- Recommended from age 2y is Randot
 - Random dot
 - Contoured
- Norms vary from test to test and even between editions of the same test

van Doorn, Evans, Edgar, Fortuin (2014)



STEREOTESTS

www.bernell.com

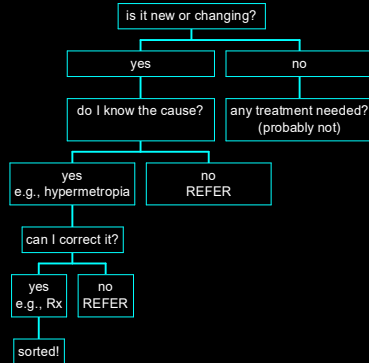


Strabismus: the bottom line for the busy optometrist

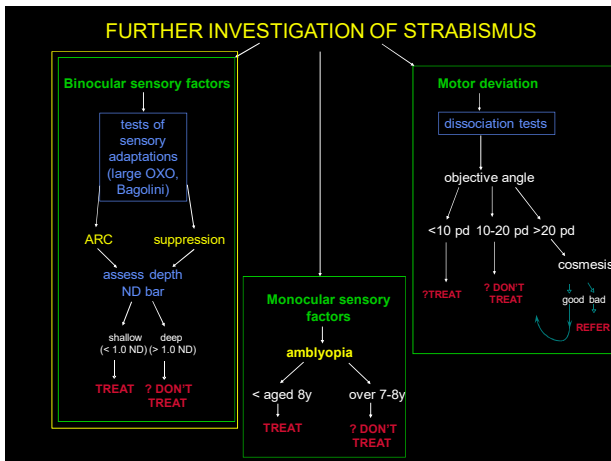
is it new or changing?

A
M
B
L
Y
O
P
I
A

Strabismus: the bottom line for the busy optometrist



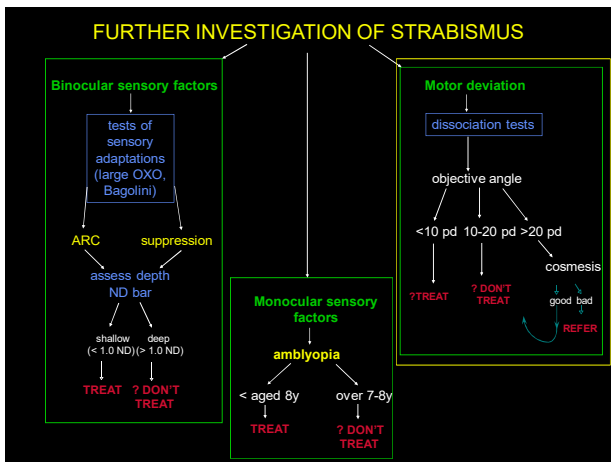
A
M
B
L
Y
O
P
I
A



SENSORY STATUS IN STRABISMUS:

Clinical overview

- If a strabismic patient does not have diplopia they must have global suppression or anomalous retinal correspondence (ARC)
- global suppression and ARC develop usually before 6 years
- over 25Δ, global suppression very likely, also if exotropia
- correction of significant Rx can influence sensory status
- more naturalistic tests are preferable
 - Bagolini and modified OXO tests detect HARC in about 80-90% of cases of strabismus & can measure depth of adaptation
- Rare for cases of deep adaptations to require treatment
 - These cases are hazardous and only for the experienced



MOTOR DEVIATION: HABITUAL AND TOTAL ANGLE

- The **habitual angle** is the angle between the two visual axes which is usually present during natural viewing conditions
- Under dissociating conditions (e.g., repeated alternate covering or prolonged dissociation) the angle increases to the **total angle**

MOTOR DEVIATION: OBJECTIVE AND SUBJECTIVE ANGLE

- **objective angle** is the angle the optometrist measures, for example during cover-uncover test (habitual angle) or prism cover test (total angle)
- **subjective angle** is the angle the patient experiences
 - in HARC, this is zero
 - in NRC, this is the angle of the strabismus
- dissociation tests "can" measure the angle
 - BUT measurement may be confounded by suppression or HARC
 - some covering/uncovering may be necessary
 - BUT try to avoid building up the angle to the total angle
- different test methods give different results
- cover-uncover test may be the purest measurement
- results may vary at different times in a given patient

MOTOR DEVIATION: INVESTIGATION OF DIPLOPIA

The last thing a fly ever sees

- **Horror fusionis:**
 - Superimposition of monocular images does not occur
 - Typically with history of early onset disruption to binocularity
- **Sensory fusion disruption syndrome**
 - Superimposition occurs, but unstable
 - Typically with history of trauma

MICROTROPIA

- Definition:
 - "A small-angle strabismus" OR
 - A strabismus where the angle of strabismus equals the angle of eccentric fixation
 - No strabismus movement on cover testing
- Usually, microtropia is a "fully adapted strabismus" and no treatment is required

For regular tweets on optometric research:

Follow @BruceJWEvans

PLAN

SYMPTOMS

INVESTIGATION OF INCOMITANCY

INVESTIGATION OF HETEROTROPIA

CONCLUSIONS



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



CONCLUSIONS

- New or changing incomitant deviations should be referred
- Recent onset esotropia in a child is often caused by hyperopia and cured by correction of hyperopia
- New or changing strabismus that cannot be cured optometrically needs referral



Handout from www.bruce-evans.co.uk

for regular tweets on optometric research

Follow @BruceJWEvans