DIAGNOSIS AND TREATMENT OF OCULAR TORSION

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PEDIATRIC OPHTHALMOLOGY AND ADULT STRABISMUS

MORAN EYE CENTER

FINANCIAL DISCLOSURE

- I have no financial interests to report

DIPLOPIA AFTER MVA

- 61-year-old female complaining of "different vision in both eyes" since a motor vehicle accident eight months ago. As a result of the MVA, she sustained severe closed head trauma and was in a coma for two months.

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DIPLOPIA AFTER MVA

- **Distance VA cc**
  - OD: 20/15, J1+
  - OS: 20/20, J1
- **Mrx**
  - OD: +0.50 +0.25 x098
  - OS: +0.25 sph
- **Pupils**
  - R/R, no APD
- **Slit Lamp Examination**
  - Trace nuclear sclerosis
- **IOP**
  - 12 mm Hg OU
- **Dilated Fundus Exam**
  - c/d 0.3 OU
  - Normal macula, disc, vessels, periphery OU









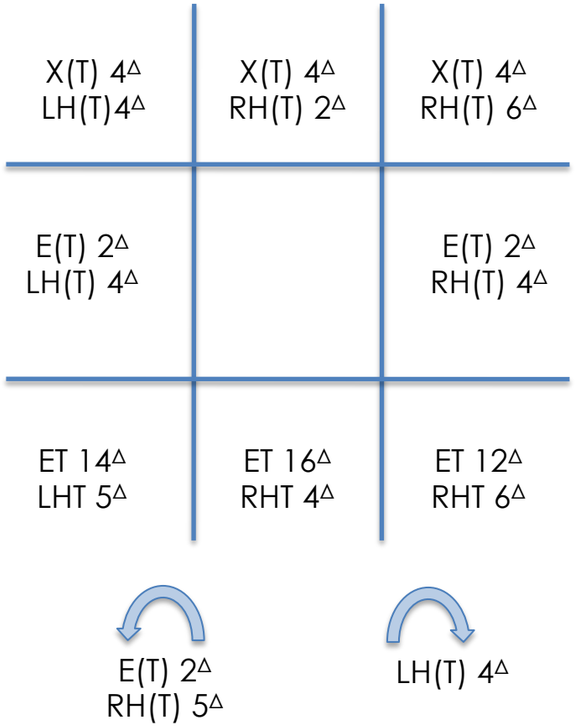
IMG_4481.JPG, 2048 x 1368 (ISO 100), 2010:04:01 13:31:22, F4.0, 1/60 s, flash On, 68.0 mm

Chin down 5°

Tilt left 2°

SENSORIMOTOR EXAM

- **Deviations**
  - Dsc: RH(T) 1^{Δ}
  - Nsc: X(T) 8^{Δ}, RH(T) 2^{Δ}
- **Stereo**
  - +Fly, 3000 arc seconds



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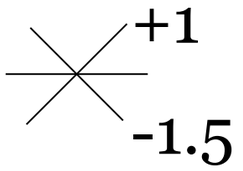
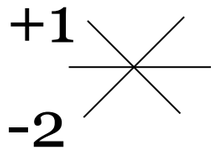
ASSESSMENT OF OCULAR TORSION

- **Deviations**
  - Dsc: RH(T) 1^{Δ}
  - Nsc: X(T) 8^{Δ}, RH(T) 2^{Δ}





- **Double Maddox Rod**
  - 2° OD excyclotorsion
  - 10° OS excyclotorsion

- **Fundus Torsion**
  - 3+ OD excyclotorsion
  - 2+ OS excyclotorsion

TORSIONAL STRABISMUS

- Abnormal rotation of the eye about the visual axis

- Malfunction of the cyclovertical muscles

TORSIONAL STRABISMUS

- Patients can usually compensate for up to 8° of cyclodeviation
- Excyclotorsion is more common than incyclotorsion
- Important part of ophthalmic examination in patients with vertical strabismus
  - Even in the absence of torsional complaints

TORSIONAL STRABISMUS

- Malfunction of cyclovertical muscles

TORSIONAL STRABISMUS

- EXCYCLOROTATED ORBITS
  - SUPERIORLY DISPLACED MEDIAL RECTI

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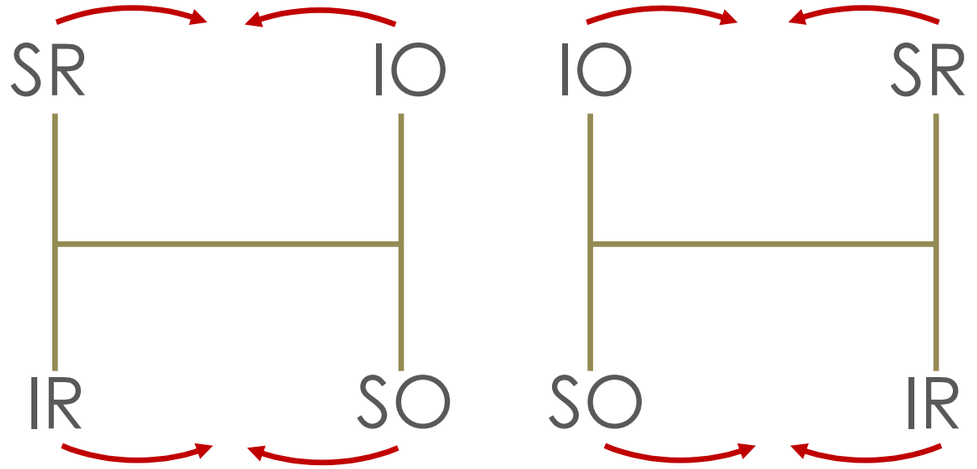
TORSIONAL STRABISMUS



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HEAD TILT TEST (BIELSCHOWSKI)

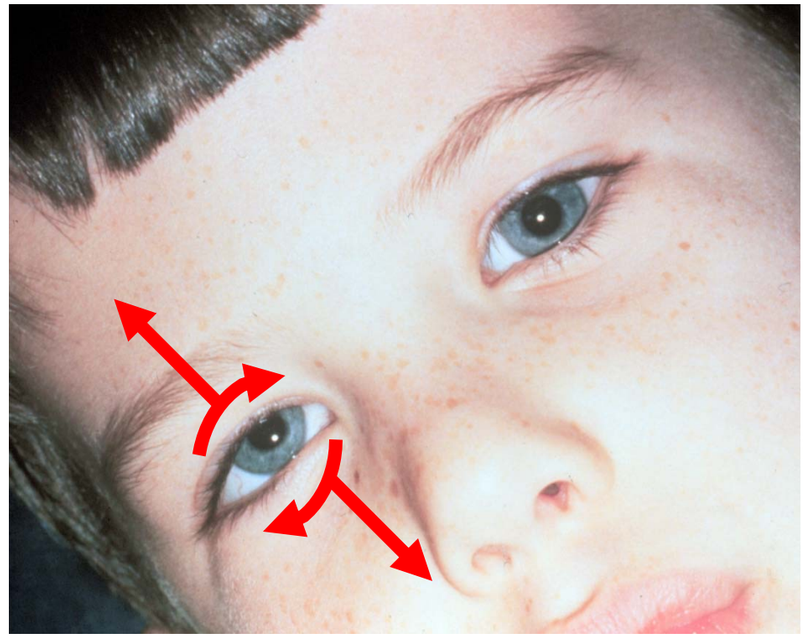
- Tilting head stimulates torsion
- Right head tilt makes right eye intort

HEAD TILT TEST (BIELSCHOWSKI)

- Tilting head stimulates torsion
- Two muscles have same torsional action
- SO and SR are both activated to intort the right eye

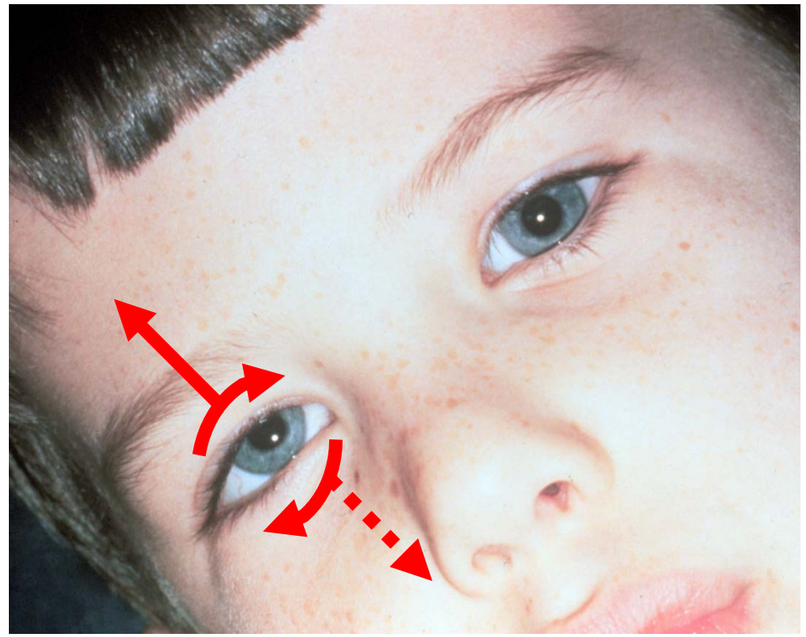
HEAD TILT TEST (BIELSCHOWSKI)

- Tilting head stimulates torsion
- Two muscles have same torsional action
- Torsional muscles also have vertical action
  - SO pulls eye down, SR pulls eye up



HEAD TILT TEST (BIELSCHOWSKI)

- Tilting head stimulates torsion
- Two muscles have same torsional action
- Torsional muscles also have vertical action
- Vertical actions imbalanced with head tilt
- SR overwhelms weak SO

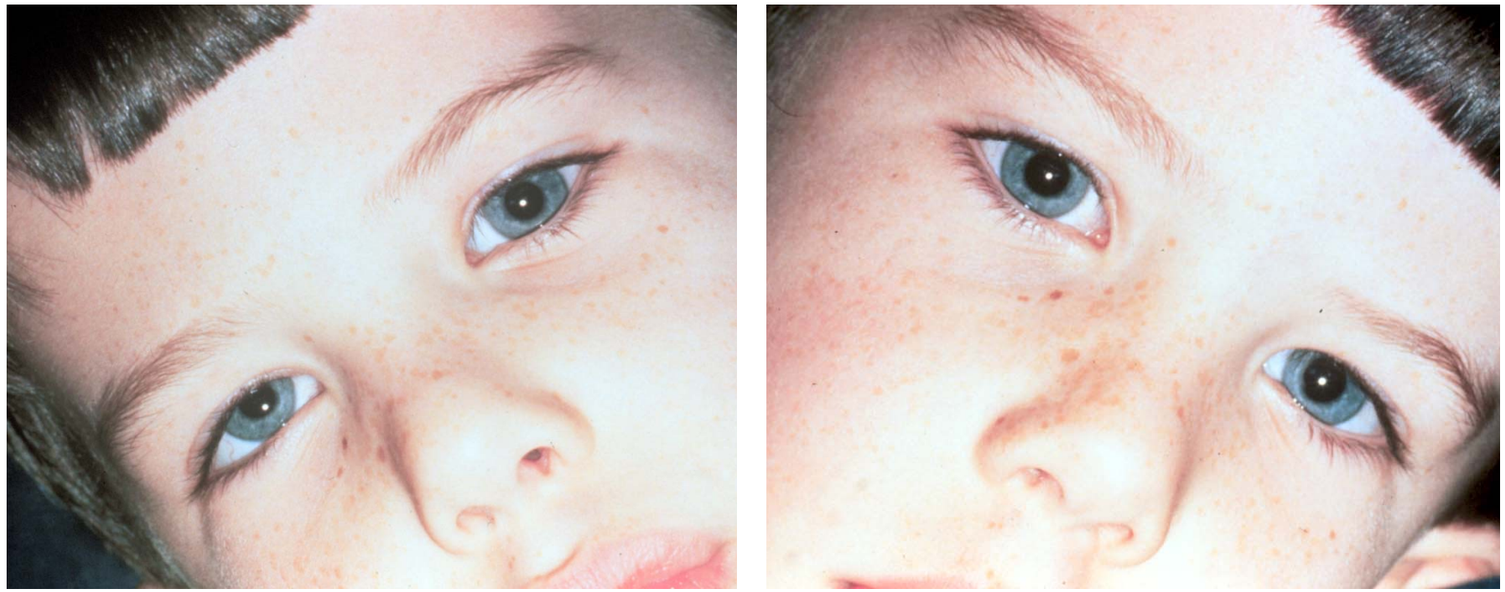


HEAD TILT TEST (BIELSCHOWSKI)

- Same torters relax if head tilted the other way
  - Head tilt left requires right eye to extort

HEAD TILT TEST (BIELSCHOWSKI)

- Deviation enhanced by head tilt
- Right hypertropia (RSOP) is worse with right head tilt

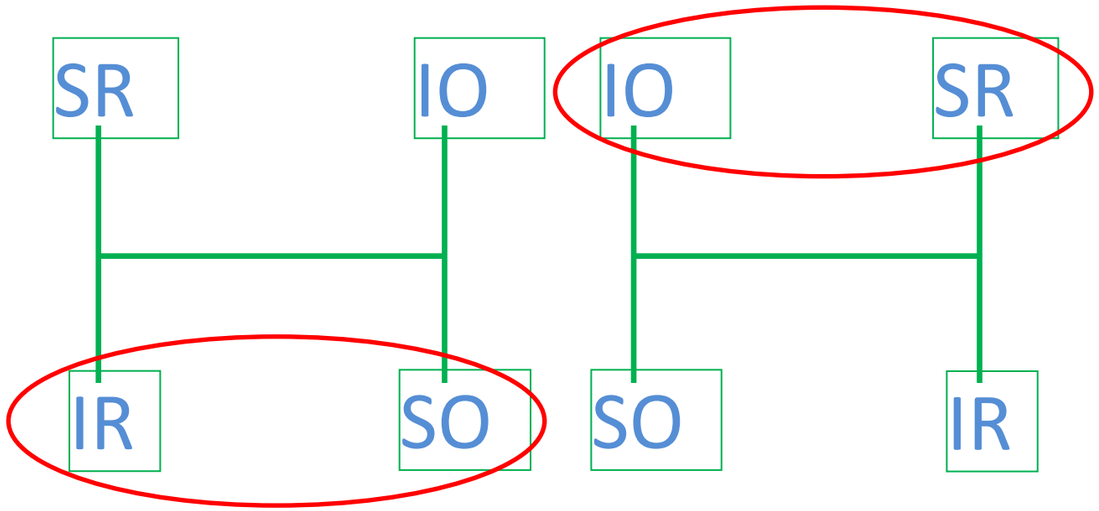


HEAD TILT TEST (BIELSCHOWSKI)

- Identifies an isolated, acute vertical muscle weakness
- Does not identify:
  - Complex deviations
  - Old deviations (tend to become comitant)
  - Vertical muscle contracture/overaction

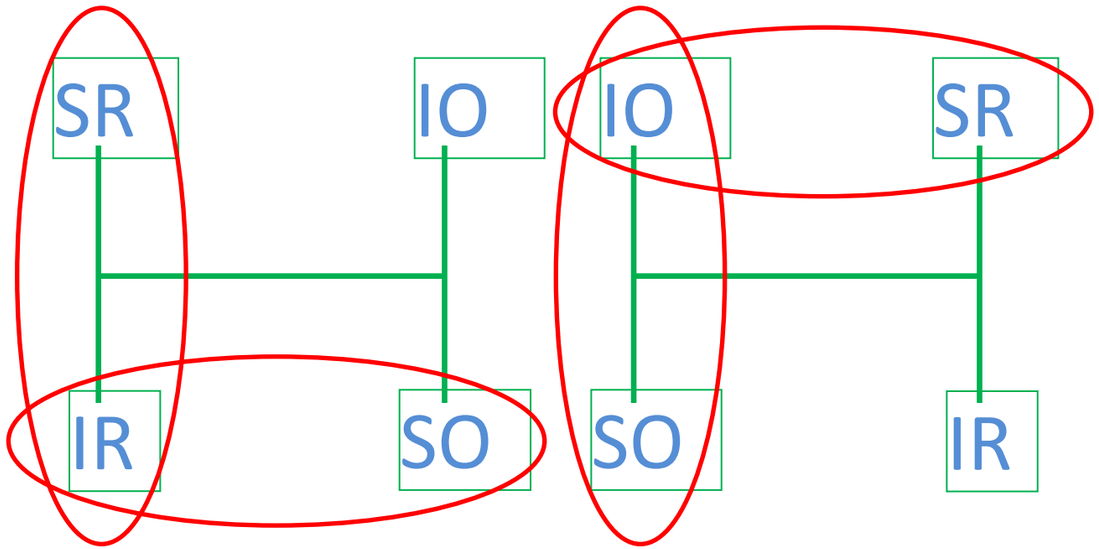
THREE STEP TEST – STEP 1

- If right hypertropia, circle muscles that pull right eye down or left eye up



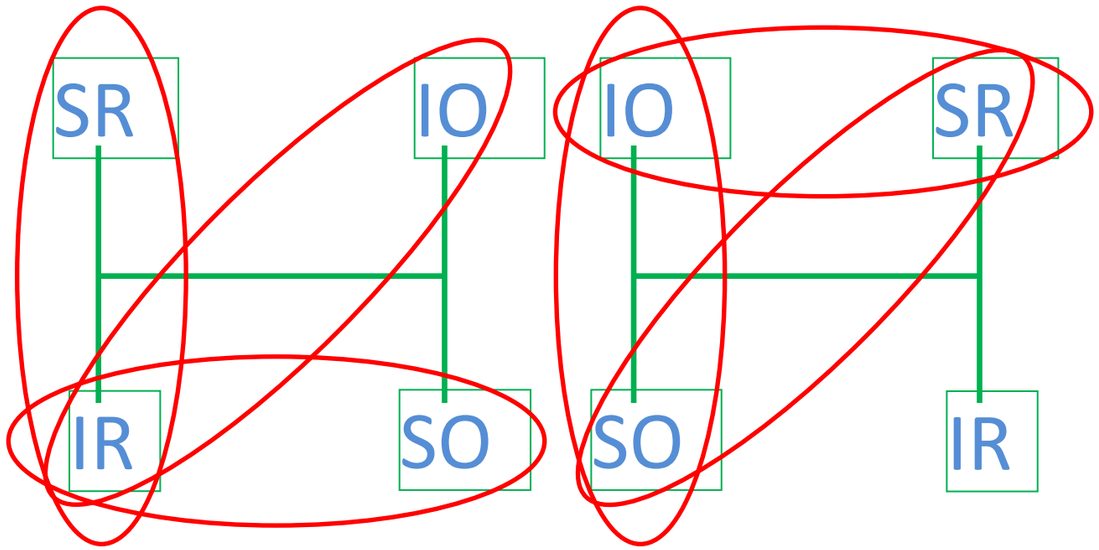
THREE STEP TEST – STEP 2

- If worse in gaze right, circle muscles on the patient's right



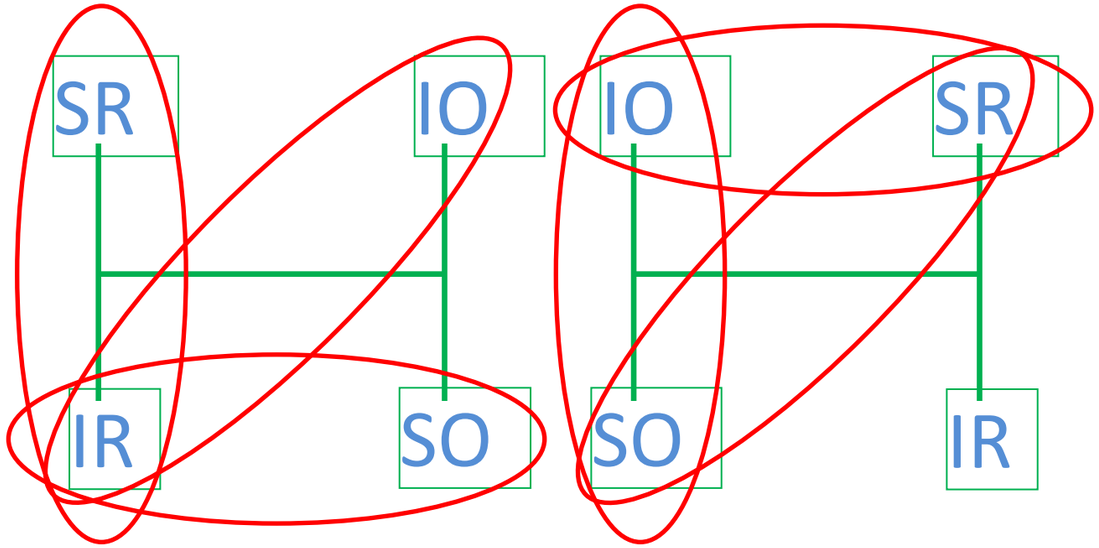
THREE STEP TEST – STEP 3

- If worse when head is tilted to the left, tilt your circles to the patient's left



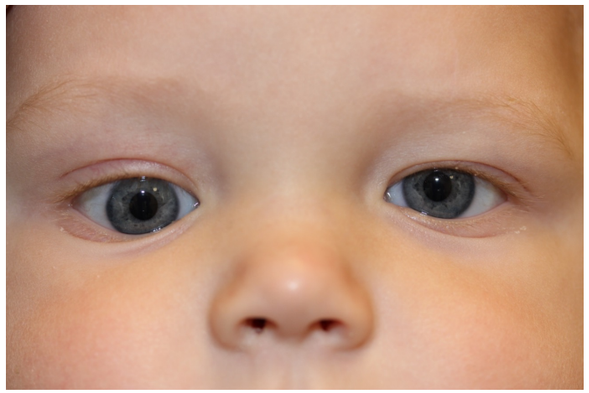
THREE STEP TEST – STEP 3

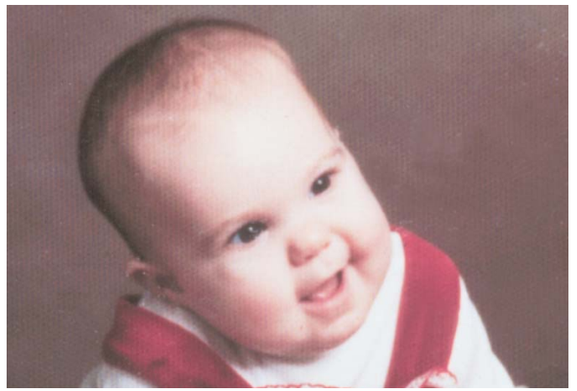
- Only one muscle is circled three times, this must be an isolated paresis of the right inferior rectus



SUPERIOR OBLIQUE PALSY

- Most common cyclovertical muscle palsy
- Can be congenital or acquired
- Can be unilateral or bilateral
  - Bilateral easily missed
- Often associated with an abnormal head posture





SUPERIOR OBLIQUE PALSY

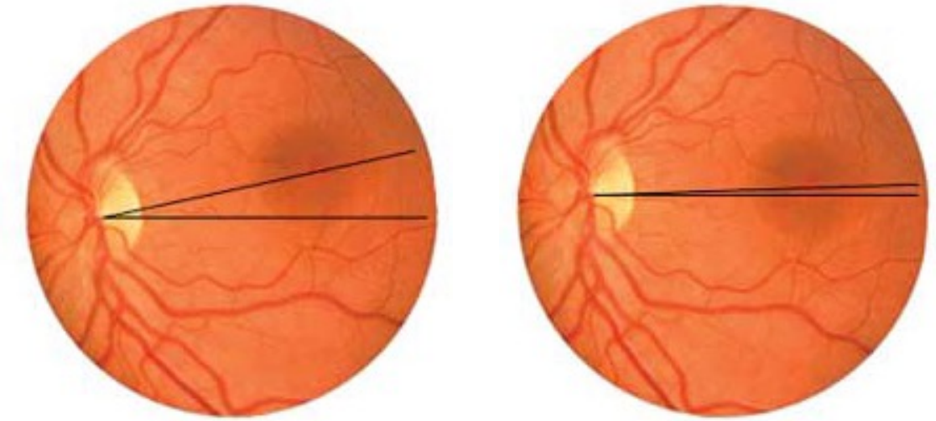
- Ipsilateral hypertropia
- Improves with contralateral head tilt
- Ipsilateral fundus extorsion
- Often associated with facial asymmetry
- Ipsilateral orbit is larger

SKEW DEVIATION

- Comitant vertical deviation
- Injury to posterior fossa structures
  - Loss of supranuclear input from the utricle and saccule of the inner ear
  - Causes ocular tilt reaction where eyes rotate toward lower ear on head tilt
- No change with head tilt

SKEW DEVIATION

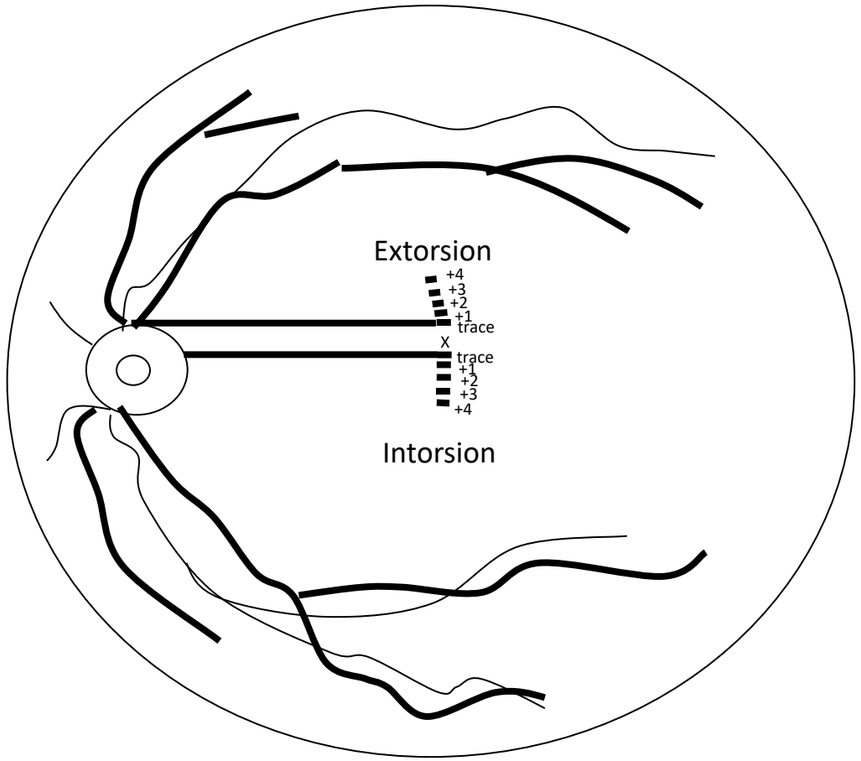
- Complementary torsion
  - Higher eye is intorted
  - Lower eye is extorted
- Diminishes in the supine position
  - Torsion decreased by 83%
  - Vertical deviation decreased by 74%



Wong AM. *J AAPOS*. 2010 Feb;14(1):61-7.

ASSESSMENT OF ANATOMIC TORSION

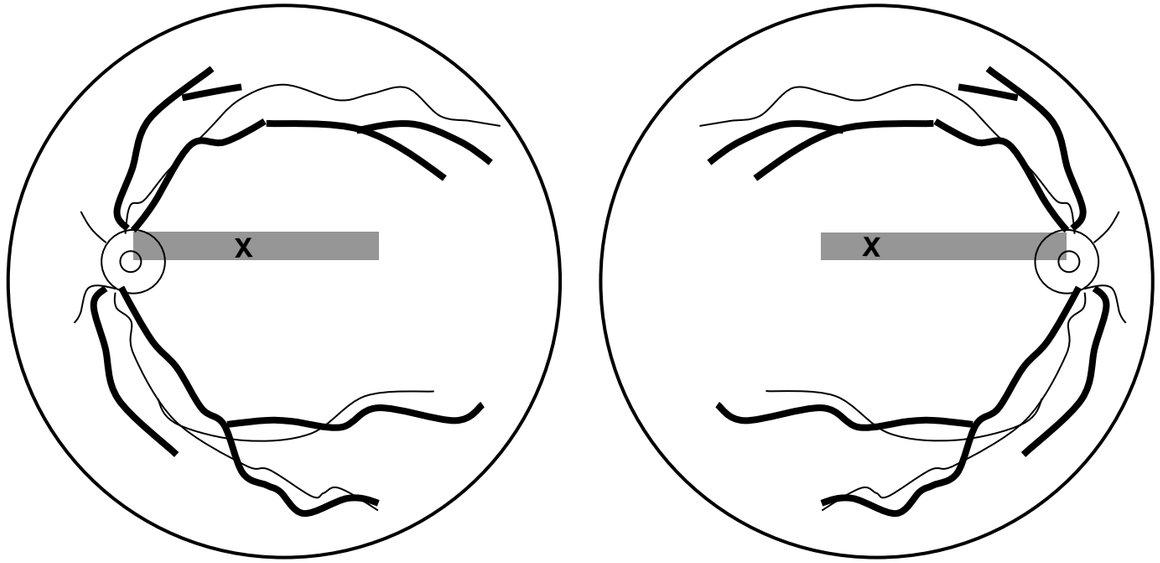
- Indirect ophthalmoscopy
- Fundus photography



ANATOMIC TORSION

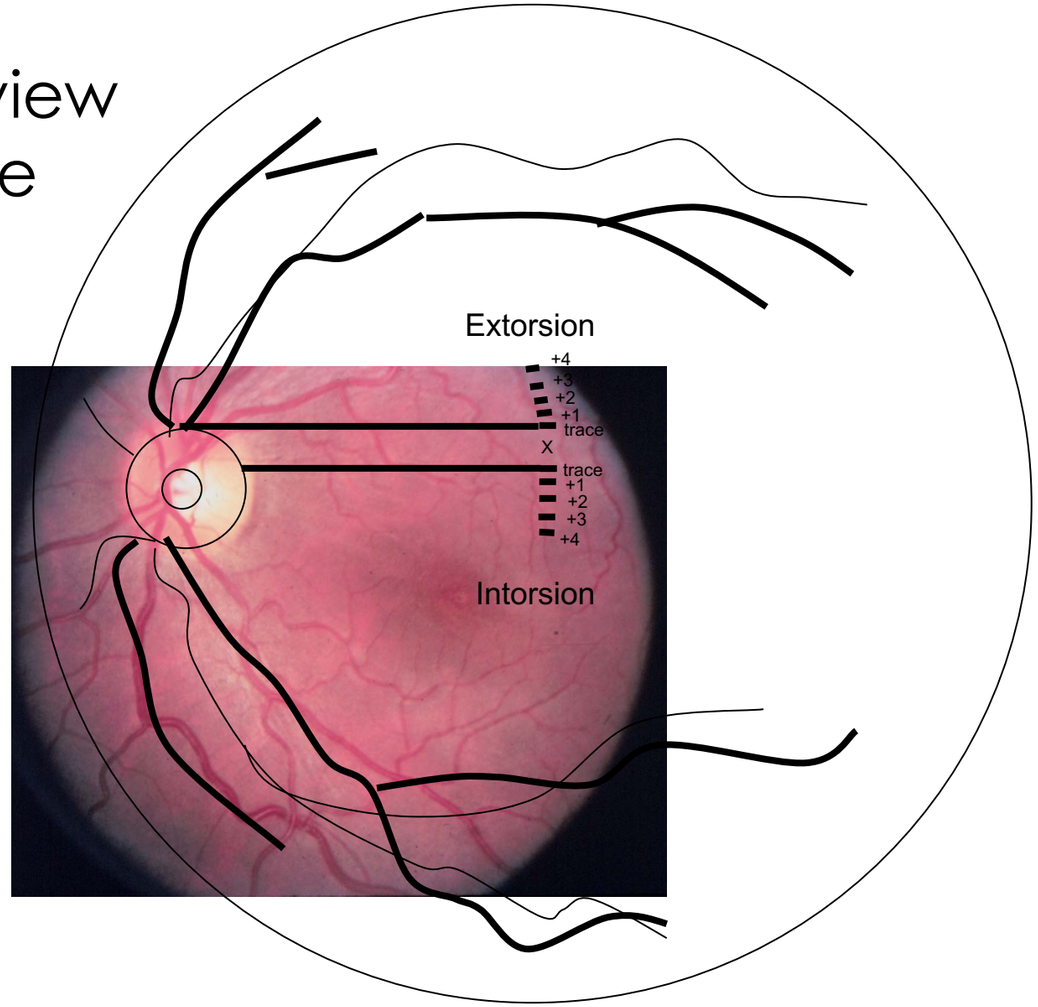
- Fovea normally found in lower 1/3 of optic nerve
  - Can vary within 12°
- Normal interocular difference < ¼ disc diameter

Indirect view



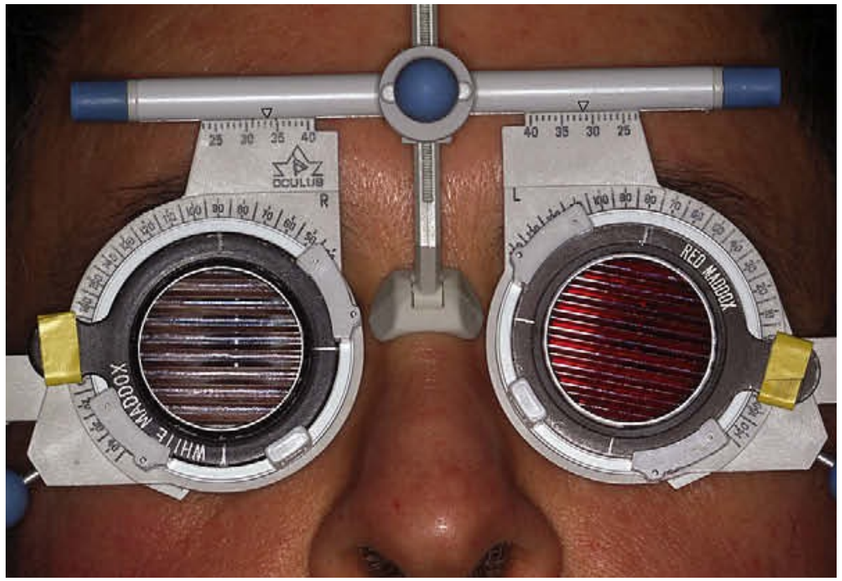
ANATOMIC TORSION

Indirect view
RIGHT eye



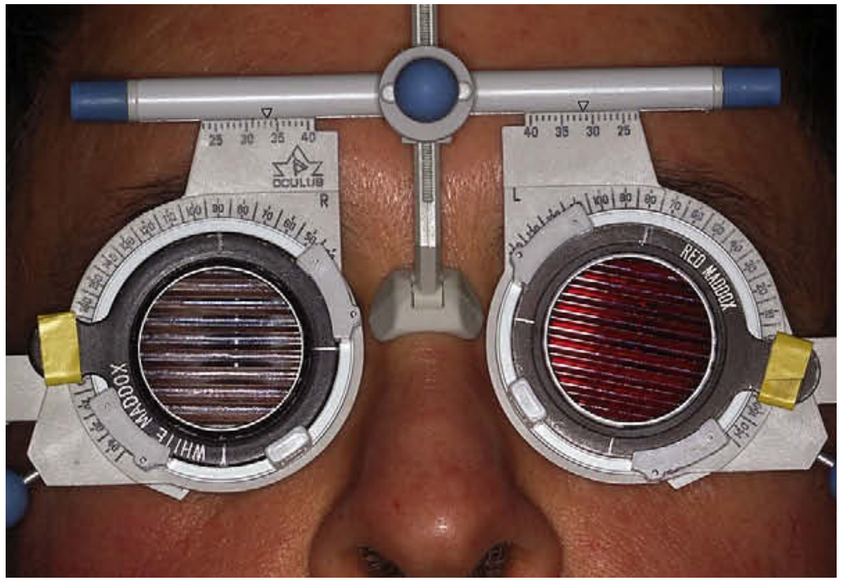
SUBJECTIVE TORSION

- Double Maddox Rod
- Patient rotates lenses to align them with the horizontal meridian
- Lancaster Red-Green Testing
- More accurate in side gazes
- Diagram of horizontal, vertical, and torsional deviations in nine diagnostic positions of gaze



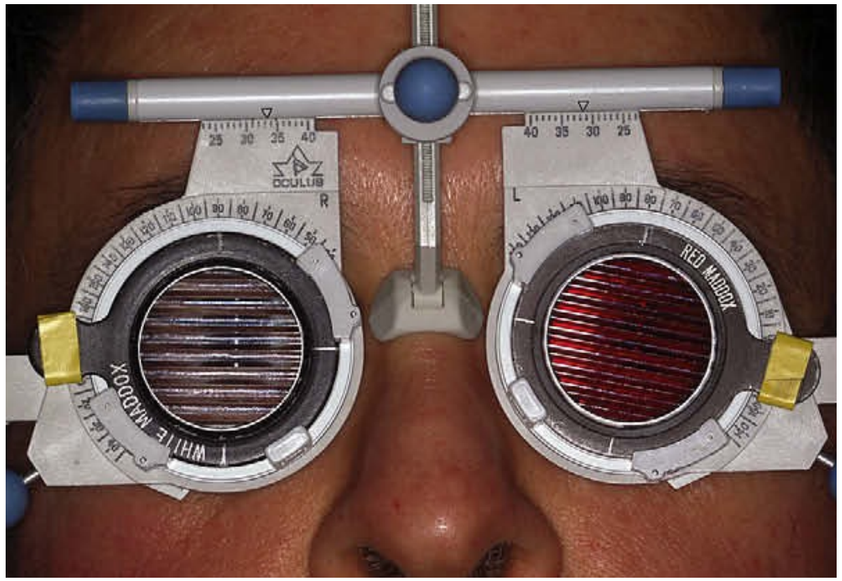
TIPS FOR USING DMR

- Obliquely orient lenses by 5-10°at the beginning of the test
- May need to use BD prism over one eye
- Completely darken room to eliminate fusional cues
- What you see is what it is



DISADVANTAGES OF DMR

- Only useful in primary position
- Head position critical
- Torsion may localize to the wrong eye

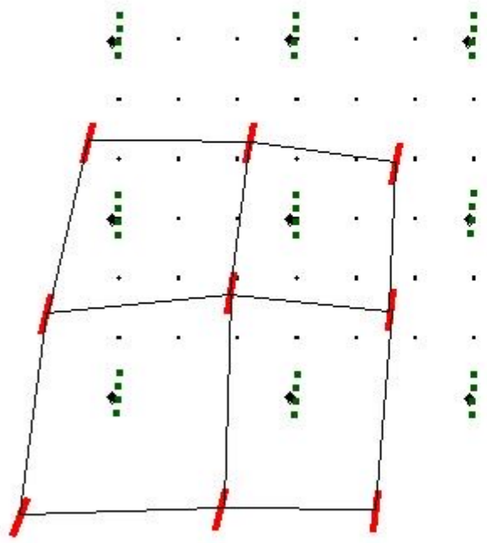


LANCASTER RED-GREEN TEST

- Diagram of horizontal, vertical, and torsional deviations in nine diagnostic positions of gaze
- Use flashlights to project streaks on calibrated screen
- Must have normal retinal correspondence

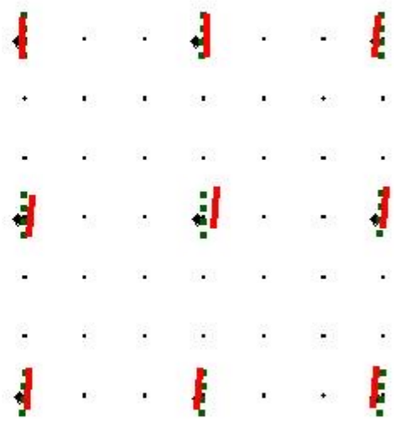
LANCASTER RED-GREEN TEST

Right eye fixing



- Right hypotropia
- Mild to moderate extorsion
- V-pattern esotropia

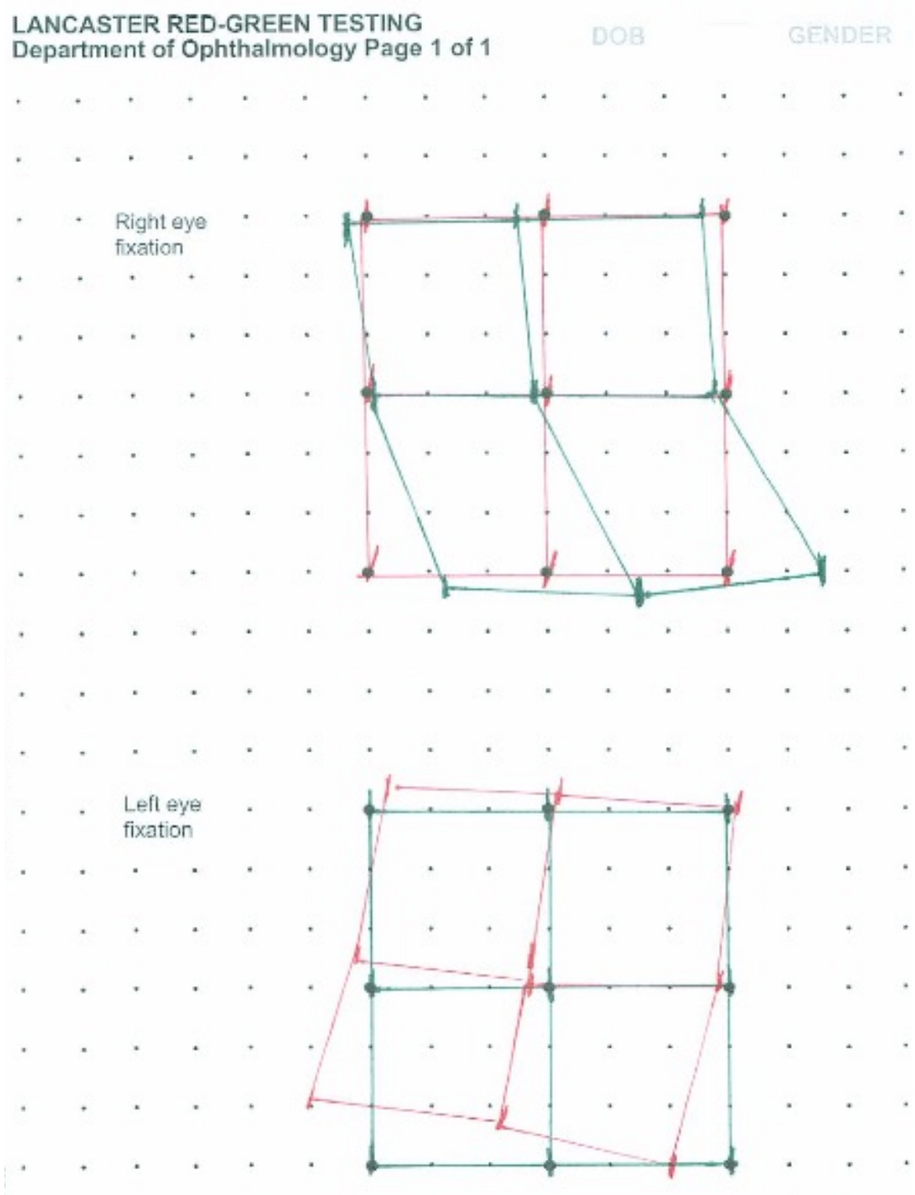
Left eye fixing



- Diagnosis: Right inferior rectus contracture

BACK TO OUR PATIENT

- Deviations
  - Dsc: RH(T) 1^{Δ}
  - Nsc: X(T) 8^{Δ}, RH(T) 2^{Δ}
- Double Maddox Rod
  - 2° OD excyclotorsion
  - 10° OS excyclotorsion
- Fundus Torsion
  - 3+ OD excyclotorsion
  - 2+ OS excyclotorsion



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BILATERAL SUPERIOR OBLIQUE PALSY

- Easily misdiagnosed
- May not have a shift in primary position
- Right hyper in left gaze (or right head tilt)
- Left hyper in right gaze (or left head tilt)
- >10° excyclotorsion
  - Most people can tolerate 7°
- Most noticable in down gaze
- V pattern
- Esotropia in down gaze

TREATMENT OF SO PALSY

- **Observation**
- Prism
- Inferior oblique weakening
- Inferior rectus recession
- Superior oblique tuck
- Harada-Ito procedure

TREATMENT OF SO PALSY

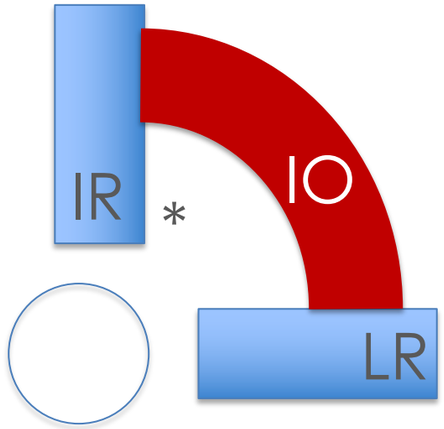
- **Observation**
  - Especially in congenital cases

PRISM

- Can be helpful for vertical misalignment
- Most vertical deviations are incomitant
- Vertical fusional amplitudes are usually between 2-6 prism diopters

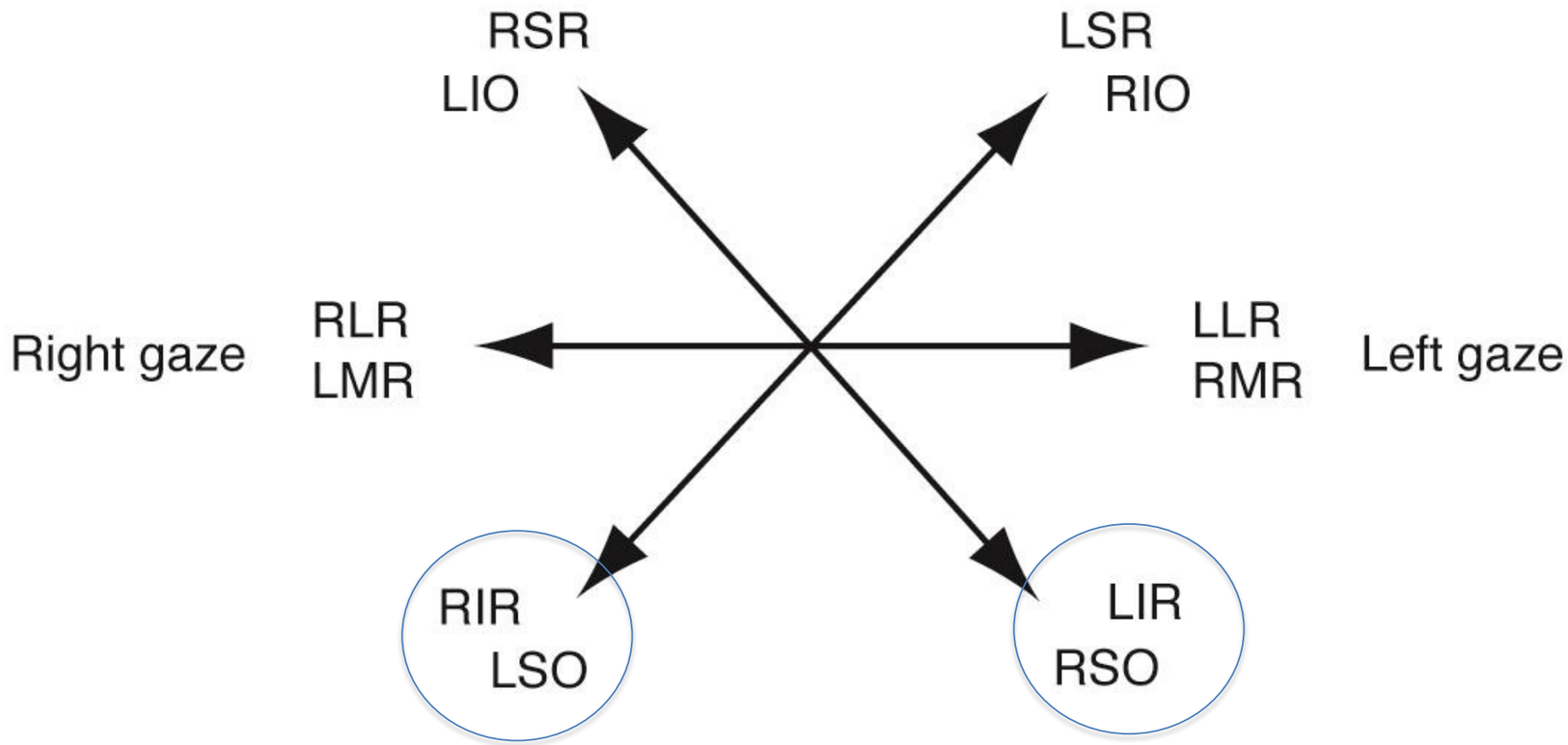
INFERIOR OBLIQUE WEAKENING

- Recession
- Myectomy



Pak J Ophthalmol 2012, Vol. 28 No. 3

YOKE MUSCLE



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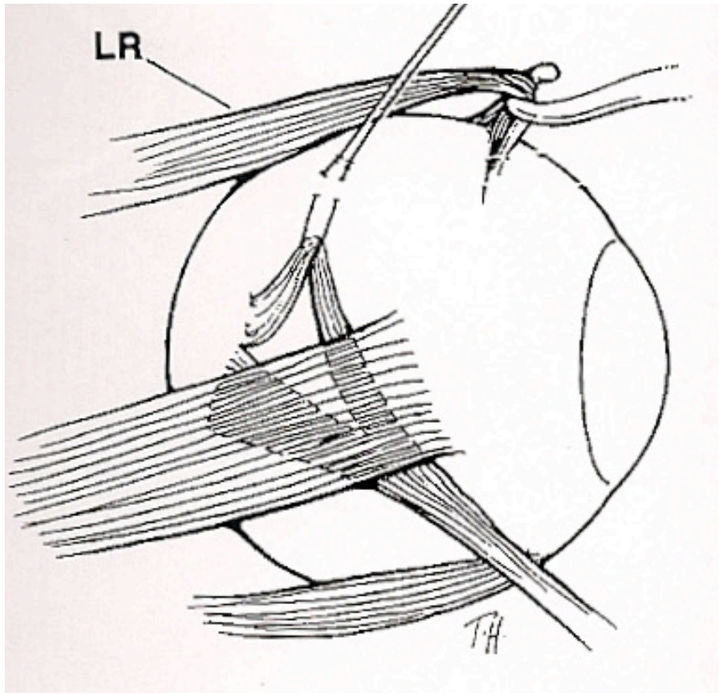
HARADA-ITO PROCEDURE

- Advancement of anterior fibers of superior oblique
- Anterior fibers are responsible for torsion
- Posterior fibers depress and abduct
- Intorts the eye without significantly changing vertical alignment



Jpn J Ophthalmol 1964;8:88-96

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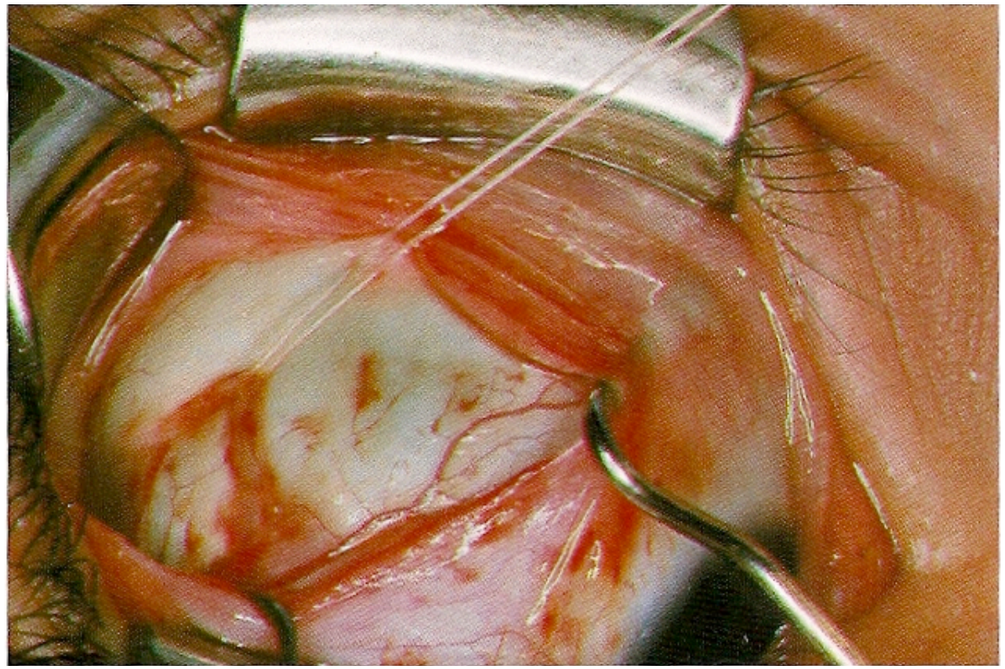
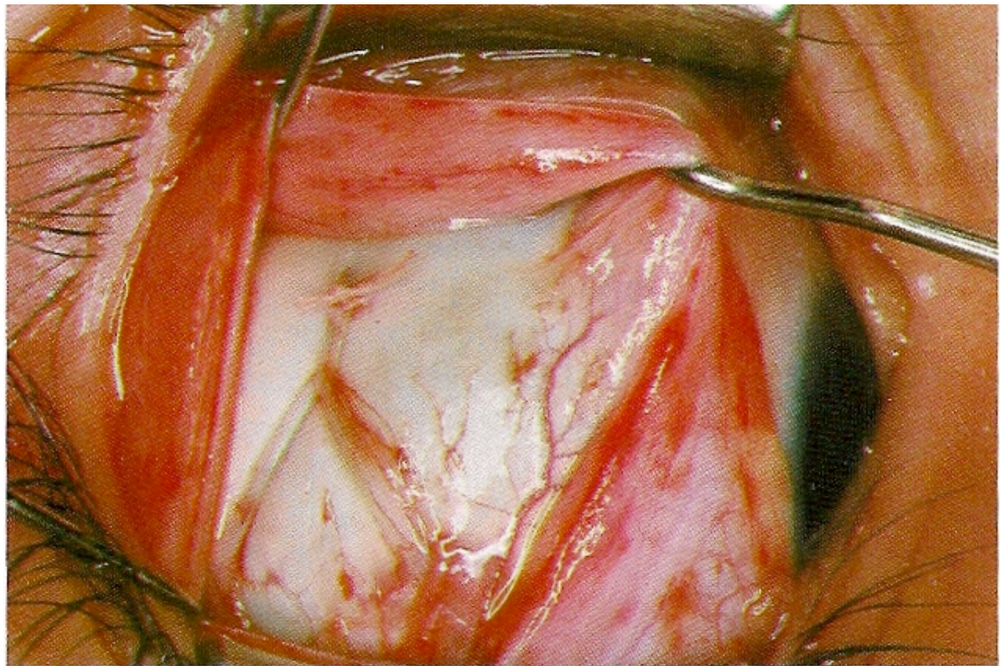
HARADA-ITO PROCEDURE





Wright, KW. Color Atlas of Strabismus Surgery. New York: Springer, 2007: 187.

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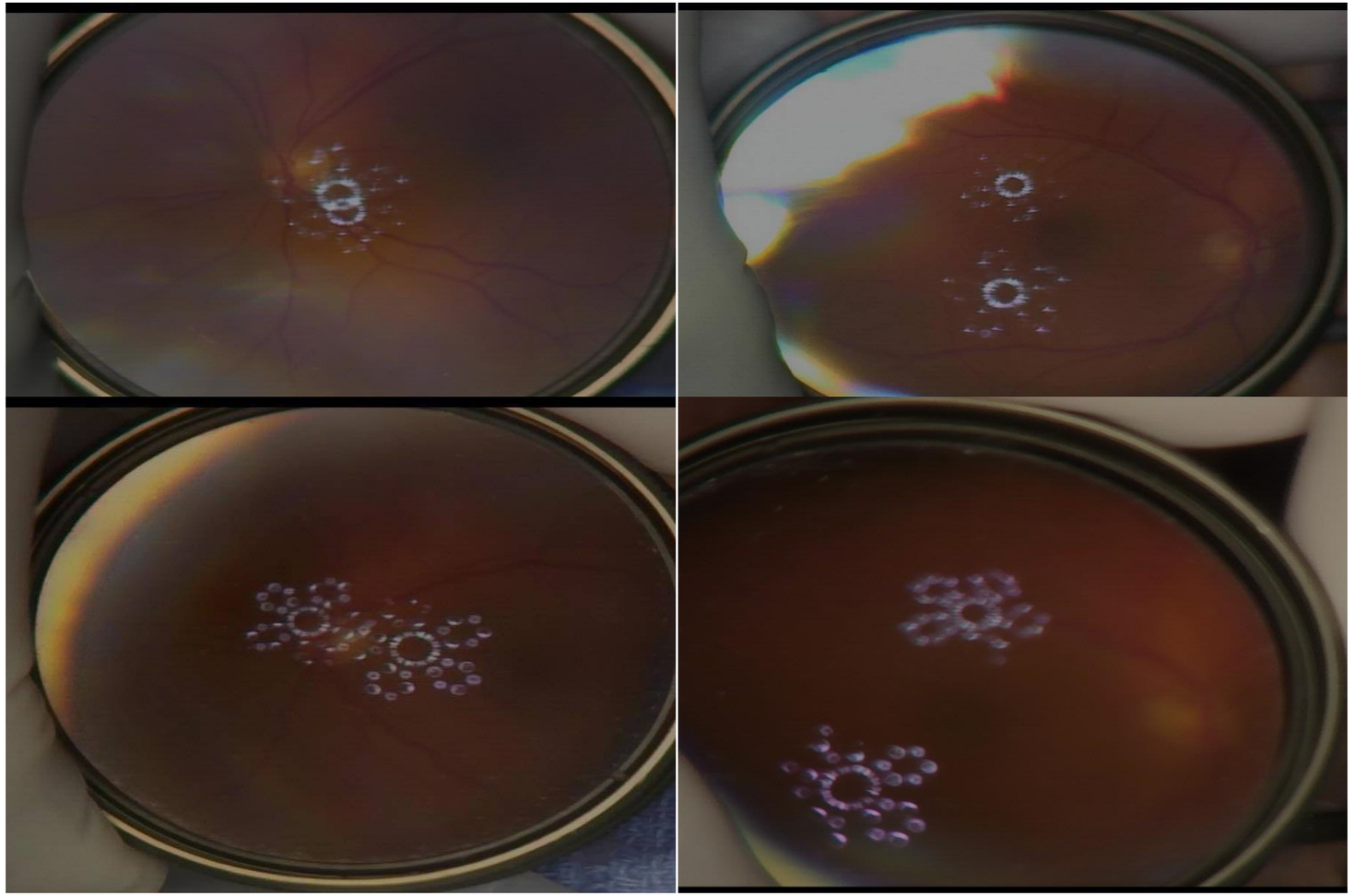
HARADA-ITO PROCEDURE



Wright, KW. Color Atlas of Strabismus Surgery. New York: Springer, 2007: 187.

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TWO MONTHS POST-OP

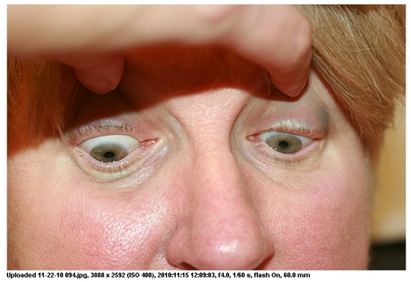
- Pleased with results of surgery
- Now able to walk comfortably without having to close one eye
- Sees double in extreme downgaze

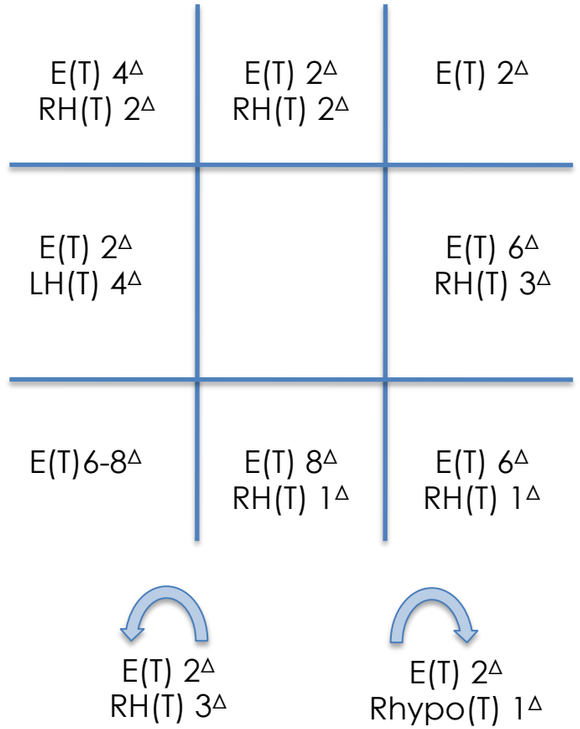
TWO MONTHS POST-OP







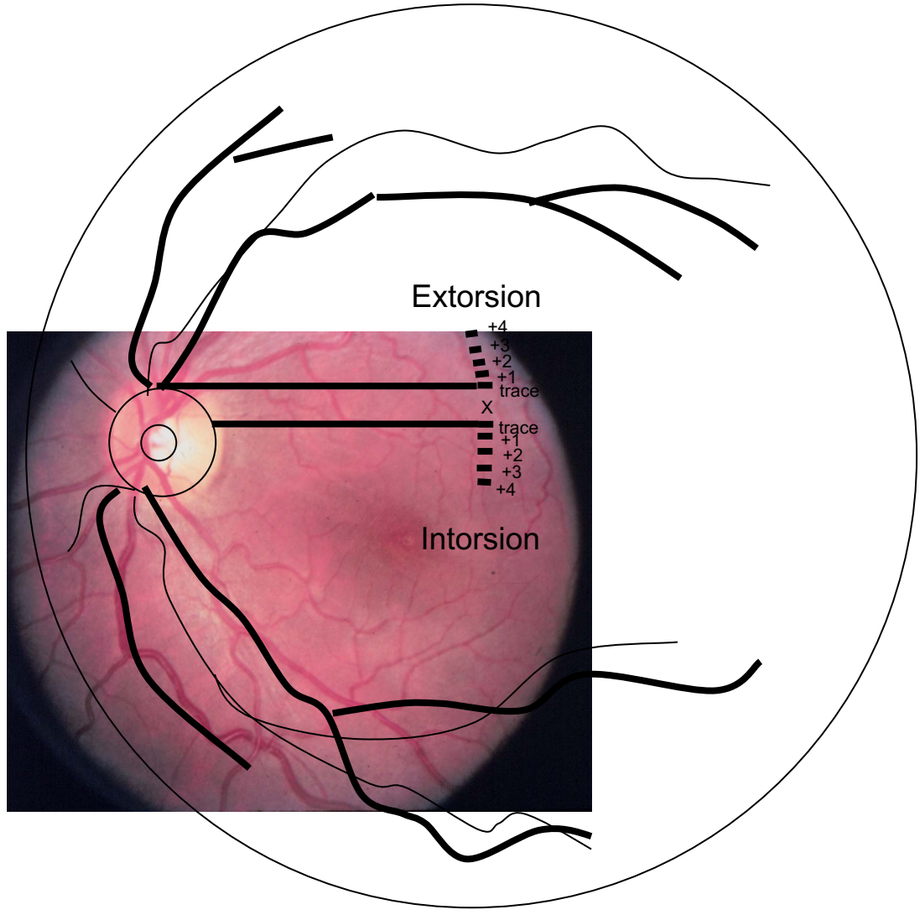



- Deviations
  - Dsc: E2Δ
  - Nsc: X1Δ
- 100 arc seconds stereoacuity
- Double Maddox rod
  - 5° incyclotorsion

SUMMARY

- Torsion can provide important information in cases of vertical strabismus
  - Even in the absence of torsional complaints
- Assess anatomic torsion using indirect ophthalmoscopy
- Assess subjective torsion using Double Maddox Rods or Lancaster red-green testing



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FOR ANY QUESTIONS OR REFERRALS

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Thank you to Dr. David Hunter, Boston Children's Hospital

PHYSICIAN REFERRAL INFORMATION FOR

Pediatric Ophthalmology and Adult Strabismus

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WHO WE ARE

At the Moran Eye Center, we can help children and adults in your care who are facing challenging eye conditions. We are committed to ensuring the best outcomes for your patients through highly skilled medical and surgical care and diagnostics.

CONTACT US

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- Retinopathy of prematurity
- Strabismus in children and adults

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