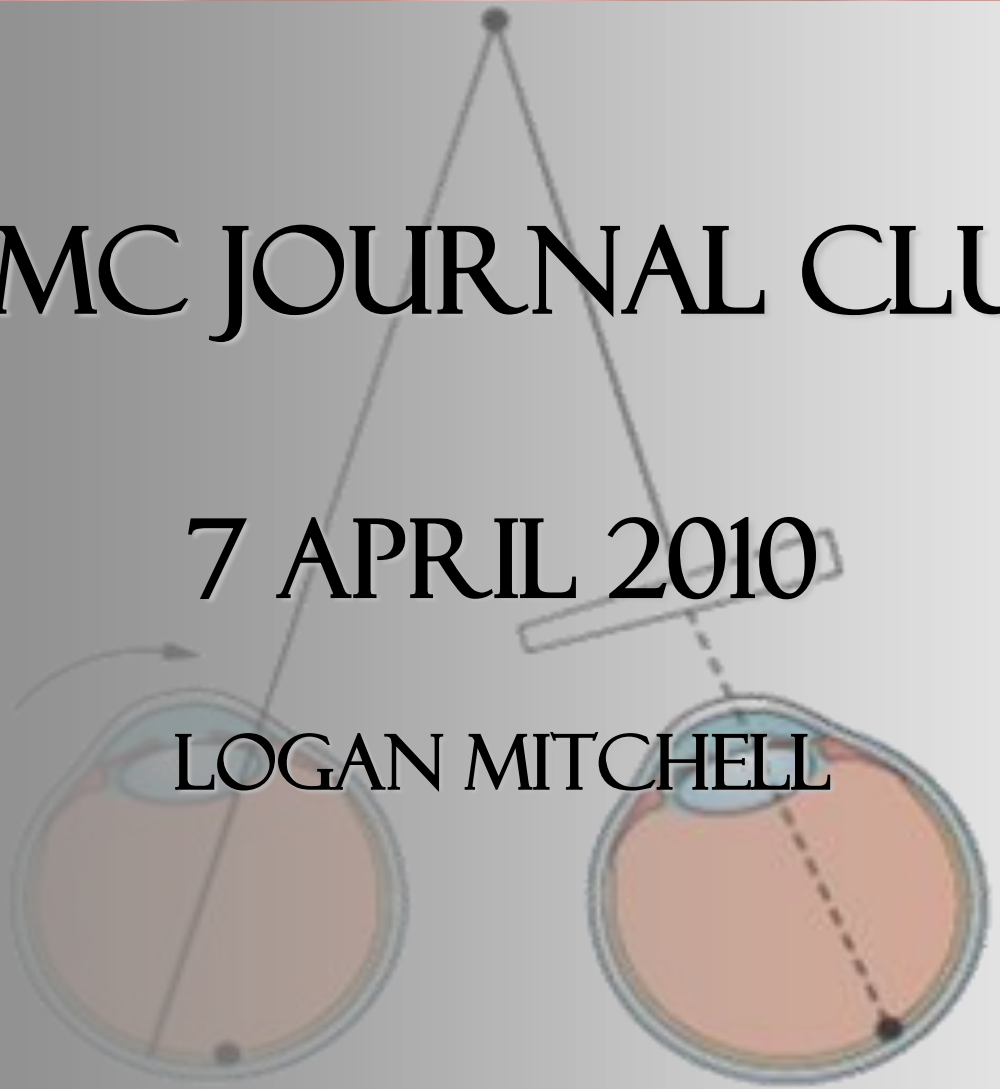
OMC Journal Club

7 April 2010

Logan Mitchell

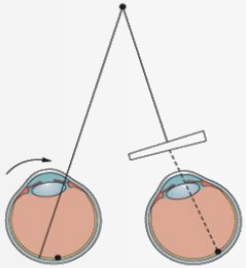


WHEN AND HOW TO STRENGTHEN THE SUPERIOR OBLIQUE MUSCLE

SAUNDERS RA

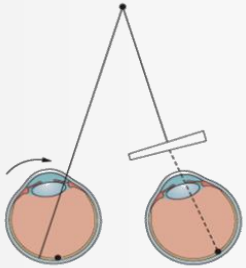
JAAPOS 2009;13:430-437

BACKGROUND



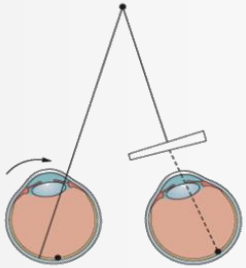
- Author from Charleston, South Carolina
  - ~100 citations, PEDIG investigator
  - 5 previous articles on SO surgery
- Article = Costenbader lecture
  - First presented at AAPOS 2009

DESCRIPTION



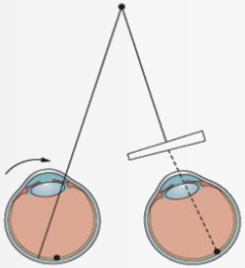
- Aim
  - Describe history of superior oblique strengthening procedures, and methods of titrating this
  - To determine any relationship between congenital onset and tendon laxity at time of surgery
- Retrospective chart review

INTRODUCTION



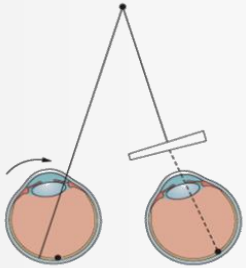
- Outline of historical reluctance to operate on SO
  - Complex anatomy and actions
  - Banister 1928 "out of the question"
- Early methods of SO strengthening
  - 1930's: plication
    - (loop of tendon sutured to sclera (Wheeler), or insertion (Foster), after *disinsertion* of SR)
  - (McLean): temporal approach – no SR disinsertion
  - 1966 (Dyer): today's method
    - Single non-absorbable suture around fold of tendon

METHODS



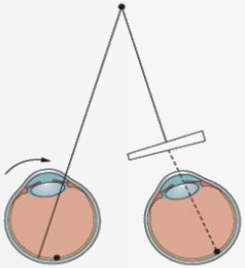
- All cases of SO tucking from 10 year period
  - 1980-85 and 2003-08
    - *As notes missing from intervening years (!)*
- Case definitions
  - SO palsy
    - Positive three-step test
  - Congenital case
    - "Early childhood" onset of strabismus *or* torticollis
    - OR later onset of above combined with facial assymetry
  - Post-traumatic OR "undetermined" case
  - DID NOT USE LAX TENDON AS CLASSIFICATION

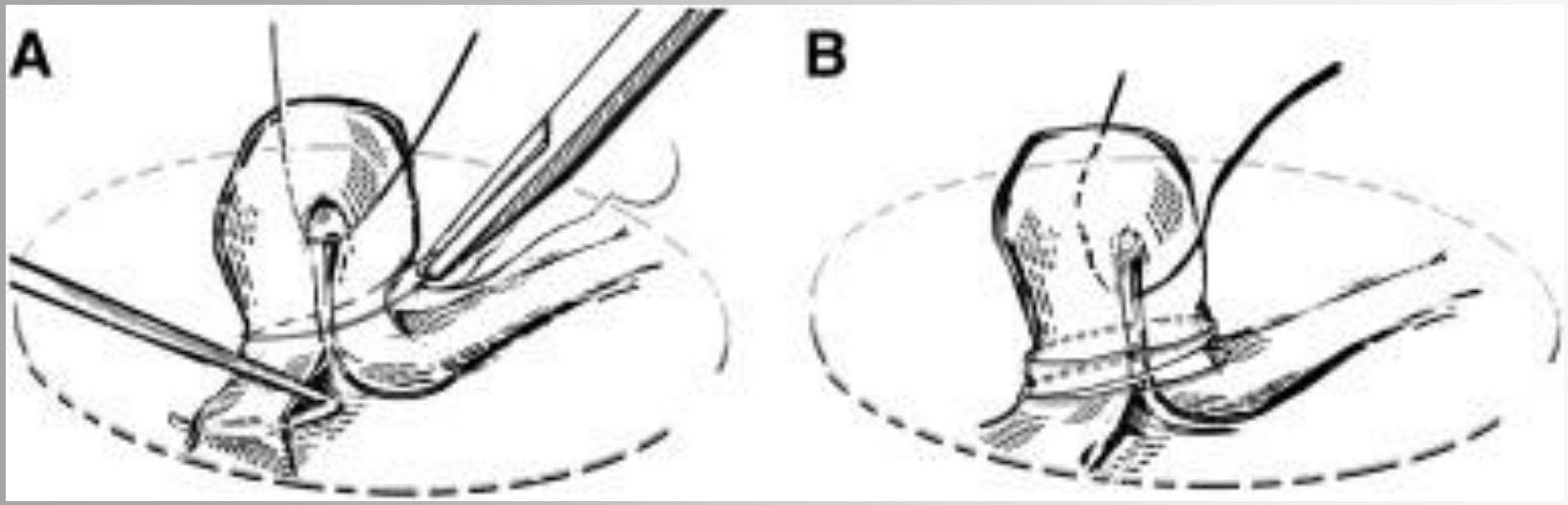
METHODS



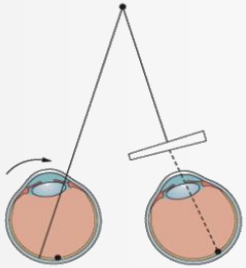
- Surgical technique
  - SO tendon isolated temporal to SR
  - Provisional tuck created with Bishop tucker
    - held with 5-0 Dacron suture
  - FDT performed (without globe retropulsed)
    - Adequate tuck when *first* resistance to elevation in adduction felt as inferior limbus passes imaginary line between medial and lateral canthi
      - Technique described by author in 1985
  - Tuck adjusted as needed
    - Final satisfactory FDT = -2 elevation in adduction

METHODS



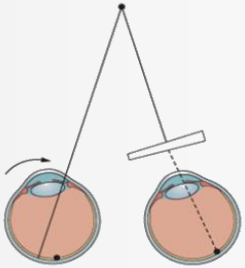


MODIFIED BISHOP TUCKER



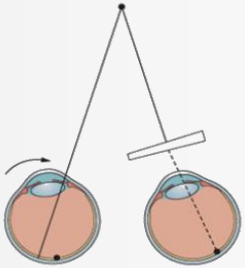
- In 2005 author's group devised Bishop tucker with internal spring and scale
  - Allowing intraoperative measurement of tension created (0-200gm)
  - Globe held in depression to perform measurements
- Used on 12 "selected" patients
  - Both congenital and acquired
  - (not otherwise specified)

RESULTS

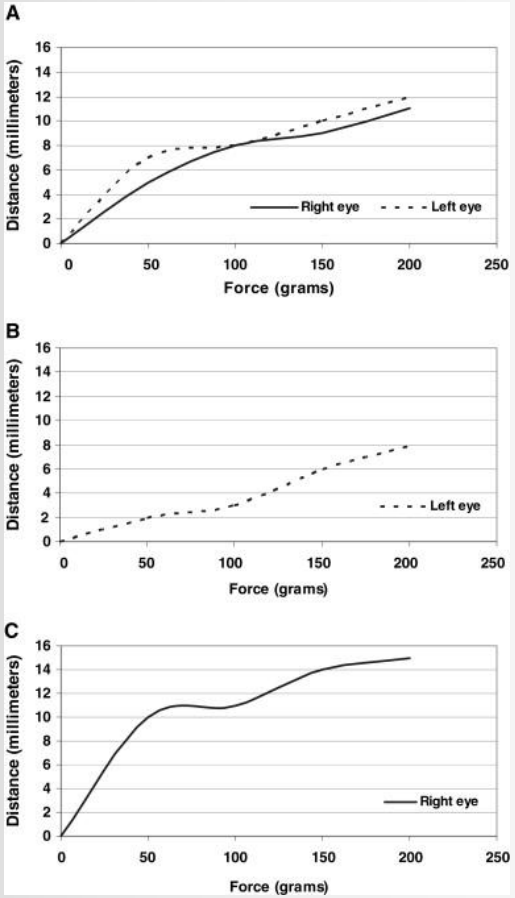


- 30 cases identified
  - 15 “congenital”, 15 “post-traumatic” or ”undetermined”
    - Average 20.4^ hyperdeviation in primary (range 2-55)
  - Second muscle operated on if required for deviation
    - N=23, including all of the “congenital” group
- Mean tuck performed
  - Congenital cases: 10.8mm (8-16mm)
  - Non-congenital cases: 7.8mm (4-12mm)
  - P = 0.002
- Modest correlation between tuck and deviation
  - R = 0.30 for primary and lateral gaze

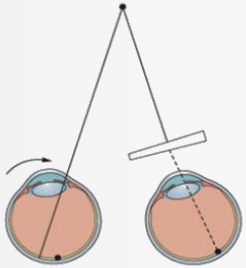
RESULTS



- Tension measurements
  - Sample length-tension graphs provided
  - "Measurements reasonably repeatable when restesting performed"

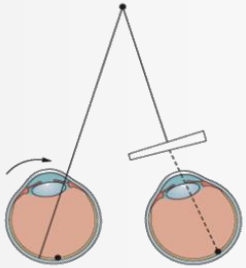


DISCUSSION



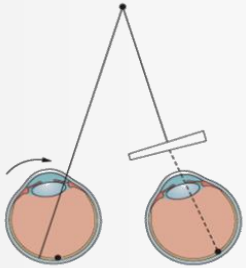
- Increased tuck noted with congenital cases
  - But note large variation (up to 12mm in non-congenital cases
- Weak correlation between deviation and tuck required previously noted
  - When correlation noted, strongest for contralateral gaze measurements
    - Noted that Knapp was vague about in which gaze his > 20^ rule applied
  - Author's conclusion that surgeon should aim to treat the contralateral gaze deviation and "the primary deviation should sort itself out"

DISCUSSION



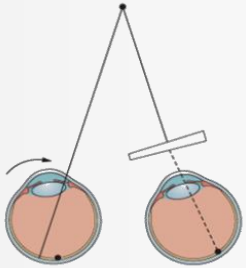
- Previous guides at tuck titration ambiguous
  - Knapp: "Bishop tucker should be snug"
  - Scott: "cause a moderate Brown's"
  - Plager: "match the FDT of the normal fellow eye"
    - No data available on this method
- Conclusions
  - Congenital SO palsies (as per study classification) do have laxer SO tendons
  - Measuring tension of SO tendon induced by tuck may prove to be valuable way of titrating surgery

DISCUSSION



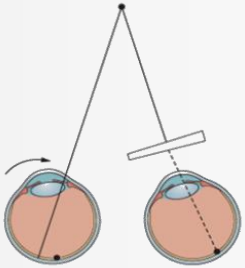
- Other points
  - Author reports 3 over-corrections (iatrogenic Brown Syndrome) with SO tucking in his 30 year career (i.e. over and above study population)
    - Only one requiring take-down of SO tuck (which was included in this study)
  - Most patients (not stated) in this study had a degree of limitation of elevation in adduction
    - Desired, often improves with time

DISCUSSION



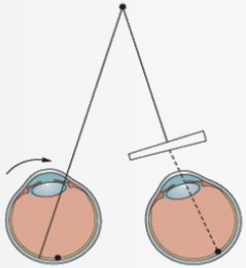
- "When to operate"
  - One paragraph explains indications for SO strengthening in non-congenital cases
    - Acquired SO palsy (less common)
      - Marked underdepression in adduction
      - Torsional diplopia
    - Residual IO overaction post IO weakening (occasional)
      - Little data on this use

CRITICAL ANALYSIS



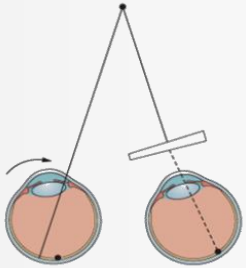
- Positive
  - Good case series operated on by one surgeon with consistent technique
  - Novel instrument devised
    - Giving previously unknown data regarding SO surgery
  - Expert, experienced opinion

CRITICAL ANALYSIS



- Negative points
  - Data lacking
    - Post-operative measurements
  - Case selection and classification issues
    - "Congenital" classification criteria debatable
    - How were 12 "modified tucker" cases selected?
  - Potential measurement / technique issues
    - Variations in position globe held in during FDT
    - Scope for wide variation in tension measurements depending on globe position

CRITICAL ANALYSIS



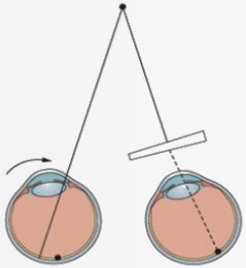
- Negative points cont.
  - Analysis lacking
    - Length-tension curves
      - No grouped data presented
      - No comparison between congenital and acquired cases
        - » (?should be much larger in acquired cases whom author describes as having “normal tendons”)

OCULAR TORSION: ROTATIONS AROUND THE "WHY" AXIS

KUSHNER BJ

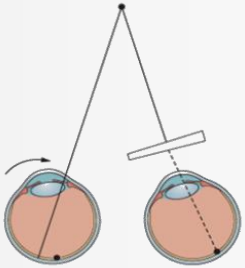
JAAPOS 2004;8:1-12

BACKGROUND



- Burton Kushner
  - Director of Pediatric Ophthalmology, Wisconsin University
  - No introduction needed
  - 150+ publications
  - Founding Editor-in-Chief, JAAPOS
- Article = Costenbader Lecture
  - Presented at AAPOS 2003

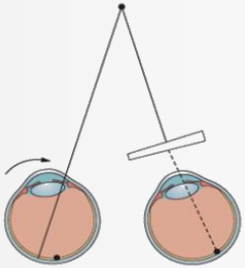
DESCRIPTION

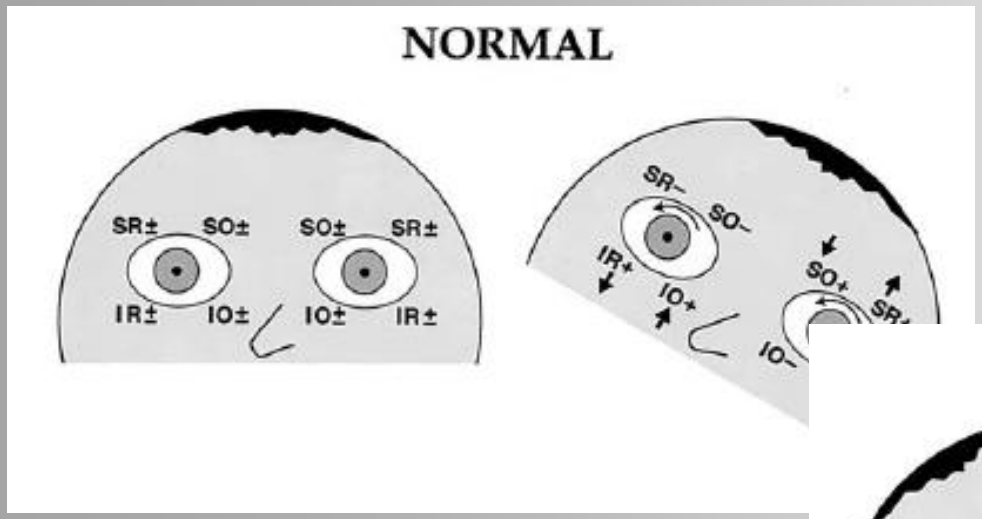


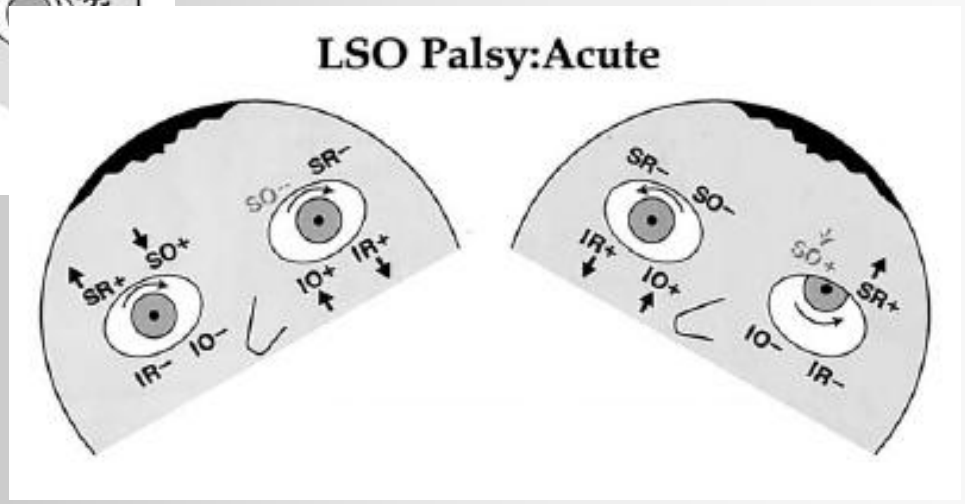
- "Traditional teaching is what you resort to when you don't actually know"
  - Amended from Kurt Adler

- Traditional teaching regarding superior oblique weakness and the Bielschowsky Head Tilt Test raises several inconsistencies
  - Addressed by literature review and "thought experiment"

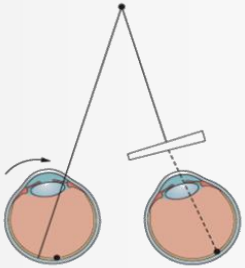
TRADITIONAL TEACHING

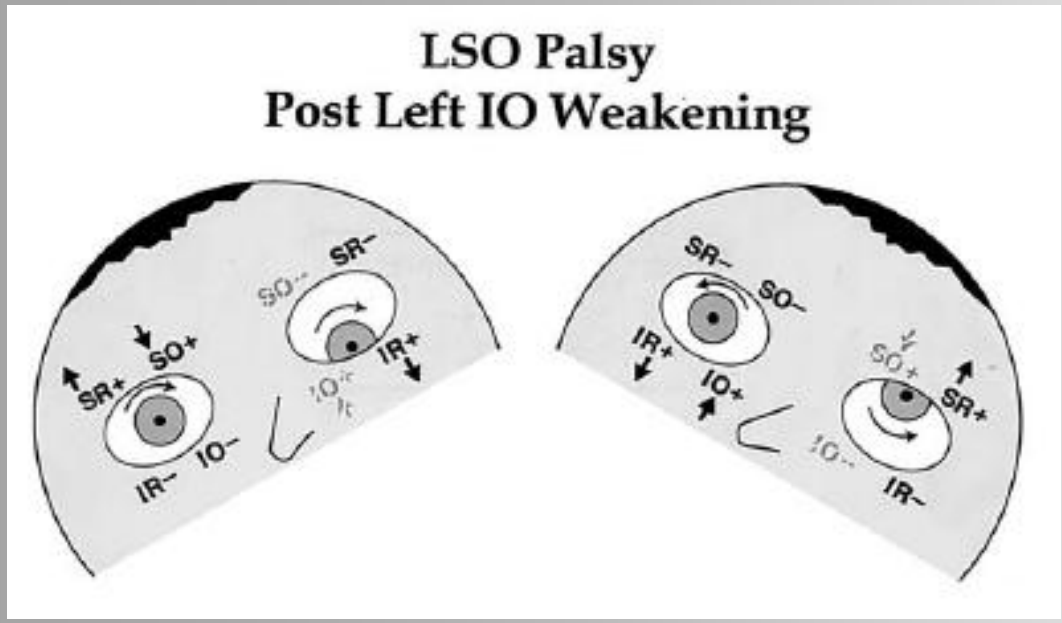






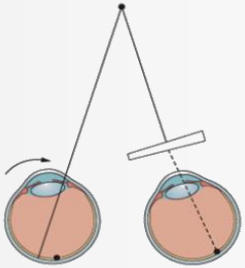
INCONSISTENCY #1





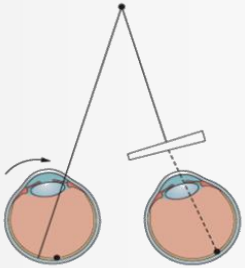
- IO weakening for SO palsy should increase BHTT difference
  - It actually decreases ~5^

INCONSISTENCY #1(A)



- Unilateral SO tenectomy and IO extirpation for SO myokomia should give positive BHTT
  - It doesn't

INCONSISTENCY #2



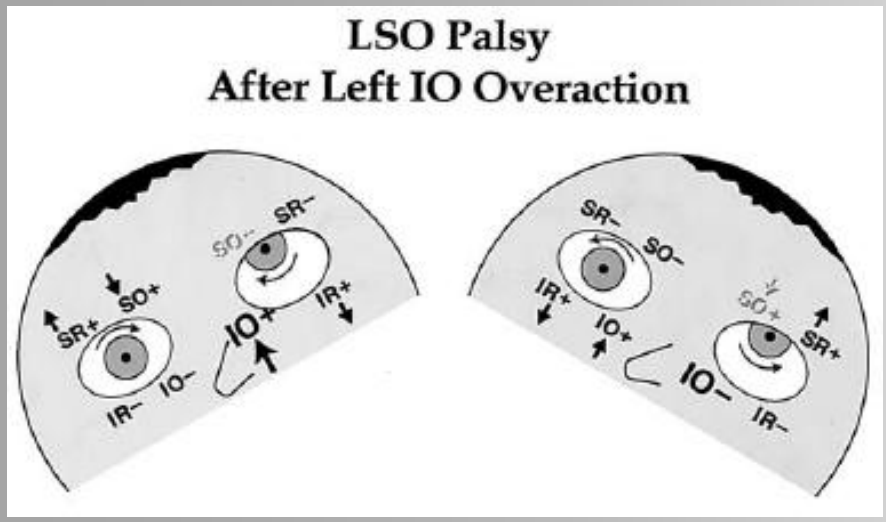


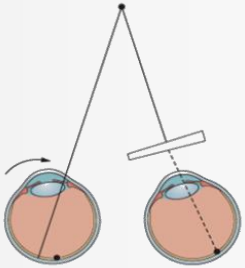
TABLE 1 Data on patients with SO palsy over the course of development of IO overaction

Data	Acute (Mean ± SD)	Later (Mean ± SD)	Paired Student *t* Test
Primary-position HT (PD)	8.6 ± 3.2	14 ± 4.9	p = .0001
IO OA (0 to +4)	0.71 ± 0.49	3.4 ± 0.53	p = .0008
Bielschowsky HTD (PD)	8.4 ± 2.6	21.3 ± 4.4	p < .0001

IO OA = inferior oblique overaction.
HT = hypertropia; *HTD* = head-tilt difference;

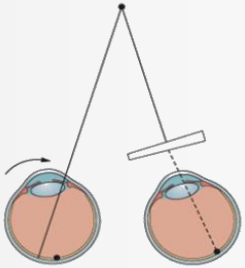
- BHTT should get less positive over time in SO palsy as IO overaction develops
  - It actually gets more positive
    - N=7 over 14 months

INCONSISTENCY #3



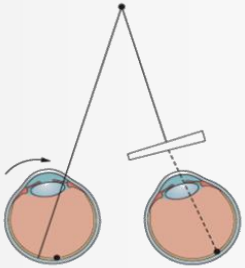
- BHTT should be just as diagnostic for vertical rectus palsies
  - It is not

INCONSISTENCY #4



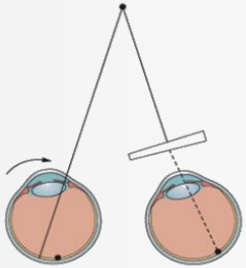
- BHTT should be more positive in bilateral SO palsies as forces that cause it for each eye should be additive
  - It is actually usually much less positive

INCONSISTENCY #5



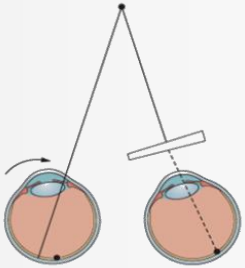
- Close observation of a globe in a tilting head should show a smooth intorsion/extorsion on ipsi/contralateral tilt respectively
  - Observation actually shows a series of cog-wheel like torsional movements (both in- and extorsional)

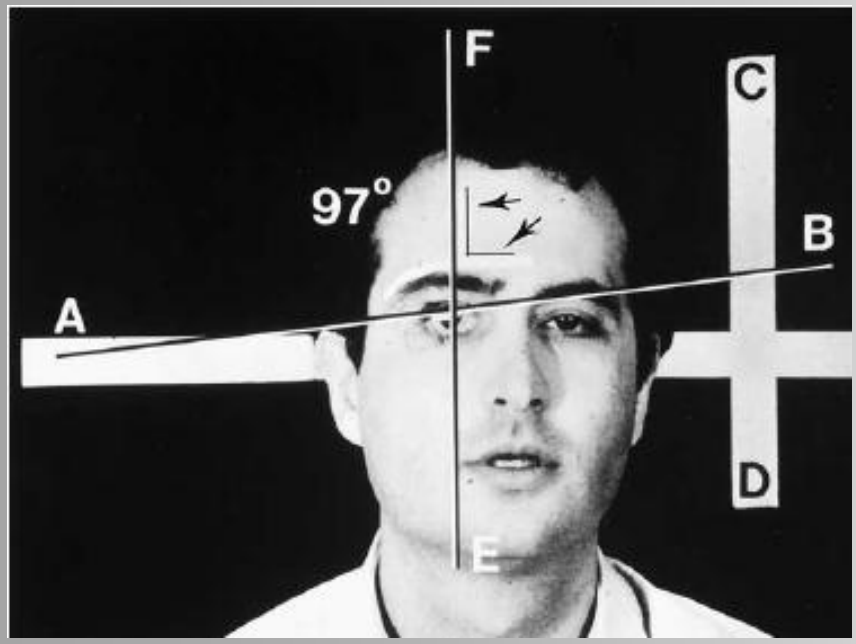
WHAT ACTUALLY HAPPENS?

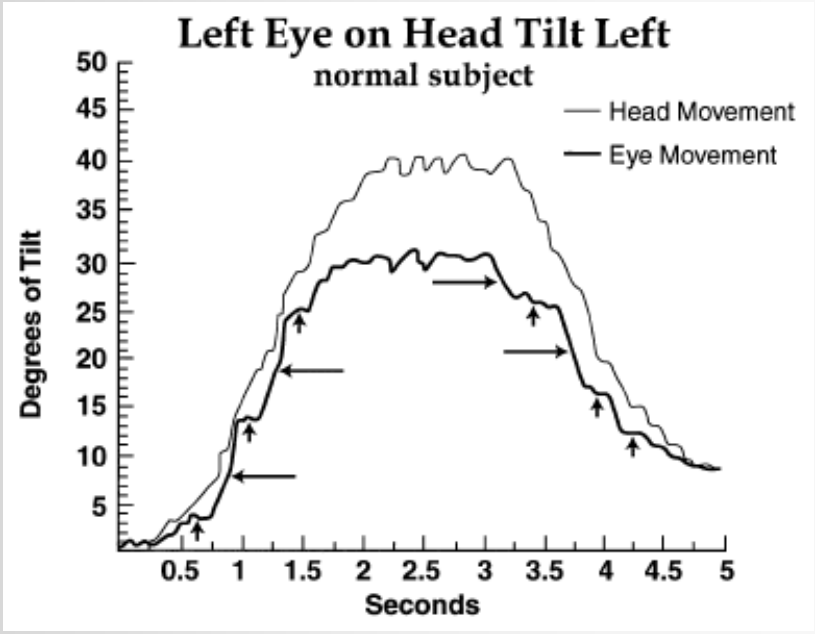


- Does torsion occur on head tilt?
  - Yes, seen in 1786 (Hunter)!
  - But it does not completely correct for head tilt
    - Usually 50% of head tilt is corrected by torsion
    - "partial compensatory countertorsion"
- Close dynamic recordings of ocular torsion on head tilt have been made
  - Petrov and Zenkin 1973
  - Kushner and Kraft 1983

WHAT ACTUALLY HAPPENS?

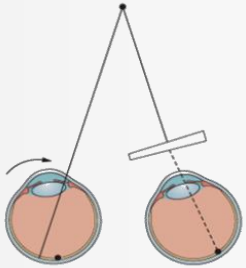






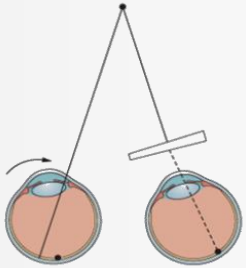
- "Compensatory dynamic counterrolling"
- "Anti-compensatory torsional saccades"
- "Static countertorsion"

WHAT ACTUALLY HAPPENS? PART 2



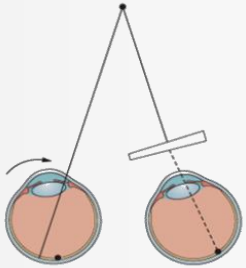
- The anticompensatory torsional saccades are not 'seen' by the eye
  - Same suppression mechanism as for horizontal saccades
- Yet final anticompensatory torsional movement can be visualised
  - (after-images, Bagolini glasses)
  - Probably a different mechanism to saccade
  - **Hypothesis**: final anticompensatory torsional movement mediated by *relaxation* of SO (extorsion) and IO (intorsion)

INCONSISTENCIES REVISITED



- Remember
  - Interplay of dynamic and static compensatory torsional movements
  - IO muscle cannot raise the globe above the midline when SR disinserted
    - And same *probably* holds true for SO and depression
  - Contracture vs overaction

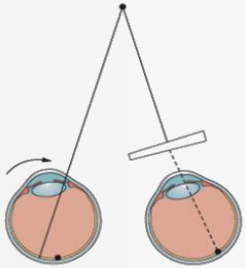
INCONSISTENCY #1 REVISITED



- *IO weakening for SO palsy should increase BHTT difference*
  - *It actually decreases ~5^*

- LIO is active in LSO palsy to produce anticompensatory torsional saccade (extorsion) on L head tilt
  - When overacting may overpower LIR increasing LHT
  - Post-surgery LIR is relatively unopposed on LHT thus decreasing BHTT positivity

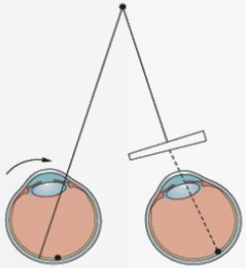
INCONSISTENCY #4 REVISITED



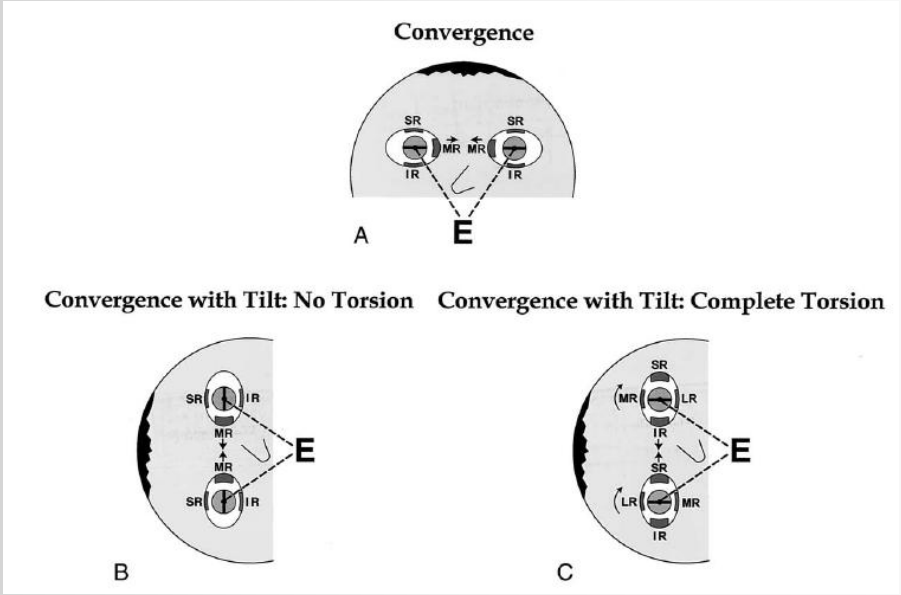
- *BHTT should be more positive in bilateral SO palsies as forces that cause it for each eye should be additive*
  - *It is actually usually much less positive*

- The forces that cause the BHTT measurement are antagonistic for each eye (compensatory torsional movements vs anti-compensatory torsional saccades) and thus cancel each other out

WHY DOES TORSION OCCUR ON HEAD TILT?

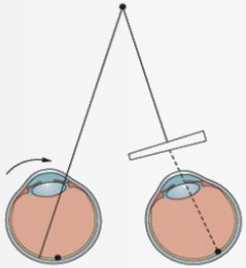


- Dynamic counterrolling movement minimises retinal slip and subsequent peripheral visual degradation
- Anti-compensatory torsional saccades occur to preserve convergence and stereopsis
  - If 90 torsion occurred, convergence would need to be mediated by IR and SR
  - Too great a vertical disparity will not allow fusion



Interestingly torsional movements are greater in lateral-eyed and elongated-fovea animals (eg rabbit)

ANALYSIS



- A great read!
- Expert, intelligent and logical thought
- Well-written

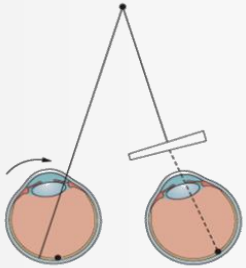
- A reply to Dr Jampel describes the technique to display the static ocular counterrolling oneself
  - Using retinal afterimage and Maddox rod or Bagolini lenses

PARETIC SIDE/NORMAL SIDE RATIOS OF CROSS-SECTIONAL AREAS OF THE SUPERIOR OBLIQUE MUSCLE VARY LARGELY IN IDIOPATHIC SUPERIOR OBLIQUE PALSY

UCHIYAMA E ET AL

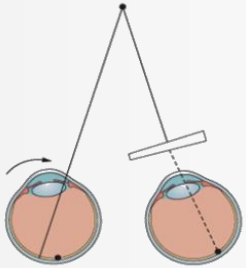
AM J OPHTHALMOL 2010;149:508-512

DESCRIPTION



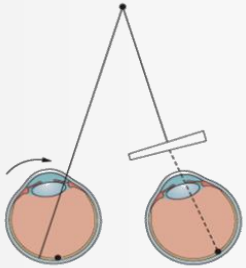
- Okayama University Medical School, Japan
- Aim
  - To search for a new definition of muscle hypoplasia in congenital or idiopathic SO palsy
- Retrospective case-control study

INTRODUCTION



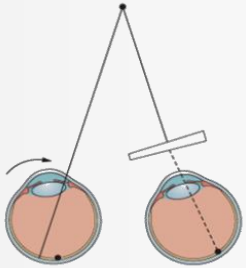
- Genetic background of congenital SO palsy suspected
  - Familial cases
  - Muscle hypoplasia or aplasia
- Recent use of MRI to assess SO muscle pre-operatively
  - Proposed use of muscle hypoplasia to classify palsy as congenital
  - But no standard definition of SO hypoplasia

METHODS



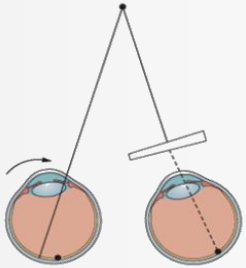
- 98 charts reviewed
  - Patients diagnosed with congenital/idiopathic SO palsy at Okyama University Hospital 1999-2008
  - [NB: patients with 'known'-cause acquired SO palsies not included]
- 50 patients had available MRI imaging
  - Varying study protocols/centres
  - Eyes closed during imaging
  - Mean age 30.9 years (range: 2-80)
- Coronal T1 slice nearest to globe-optic nerve junction photographed
  - SO and recti muscle areas measured x 5, averaged
  - Left:right ratios calculated for each muscle

METHODS



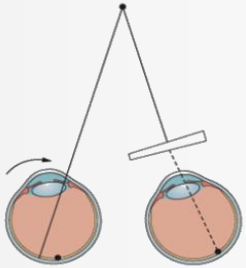
- Controls
  - 45 patients having undergone orbital imaging for other reasons
    - Mean age 51.0 – significantly older
    - Same EOM area calculations

RESULTS



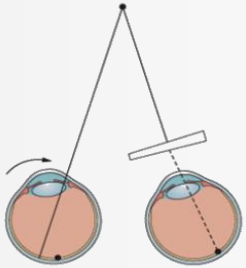
- 5 patients (SO palsy group) with SO aplasia
- Mean CSA ratios (95% CI)
  - SO palsy group
    - SO: 0.66 (0.57-0.75)
    - SO excluding aplasia cases: 0.73 (0.66-0.80)
    - Recti: 1.00 (1.00-1.00)
  - Control group
    - SO: 1.00 (0.99-1.00)
    - Recti: 1.00 (1.00-1.00)

DISCUSSION



- Most studies classify SO hypoplasia if CSA < 50% of contralateral side
- This study shows large variation in paretic SO CSA ratios, but virtually none in control patients
- Thus potential definition of SO hypoplasia:
  - If CSA ratio paretic side:non-paretic side < 0.99
- Limitations of study
  - Control group from varied clinical settings, different age
  - Different imaging protocols, slice positions
  - Eyes closed during imaging – not true coronal slices
- May lead to better classification of congenital SO palsy and provide better basis for genetic analysis of disease

ANALYSIS



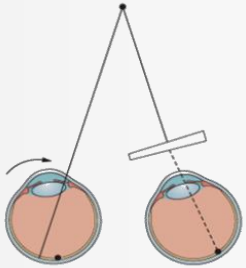
- Possible merits in using acquired SO palsy cases as controls
  - To investigate utility in differentiating congenital vs acquired cases

MRI IMAGING OF FAMILIAL SUPERIOR OBLIQUE HYPOPLASIA

KIM JH AND HWANG J

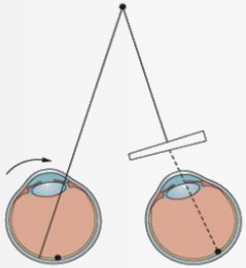
BR J OPHTHALMOL 2010;94:346-50

DESCRIPTION

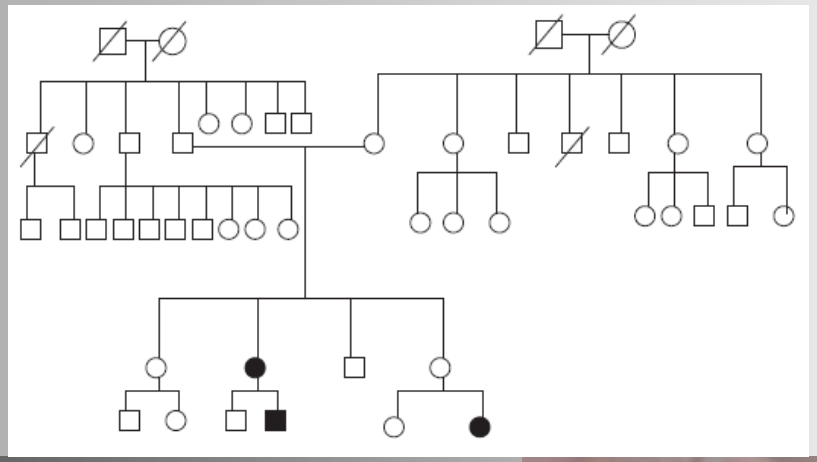


- Seoul National University
- Aim:
  - To document to familial occurrence of SO hypoplasia for the first time
- Case series

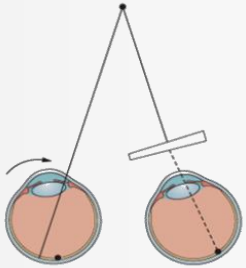
INTRODUCTION



- No previous MRI documentation of familial SO hypoplasia
- Study describes pedigree of 3 patients aged 1, 7 and 27 yrs old at time of study

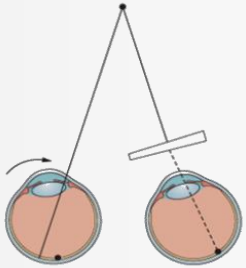


METHODS



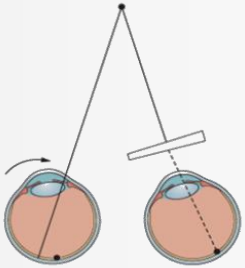
- Ophthalmological and orbital MRI examination of 3 patients in pedigree
  - All with ipsilateral SO under- and IO overaction, torticollis and positive head tilt test
- 3T MRI imaging performed under standardised protocol

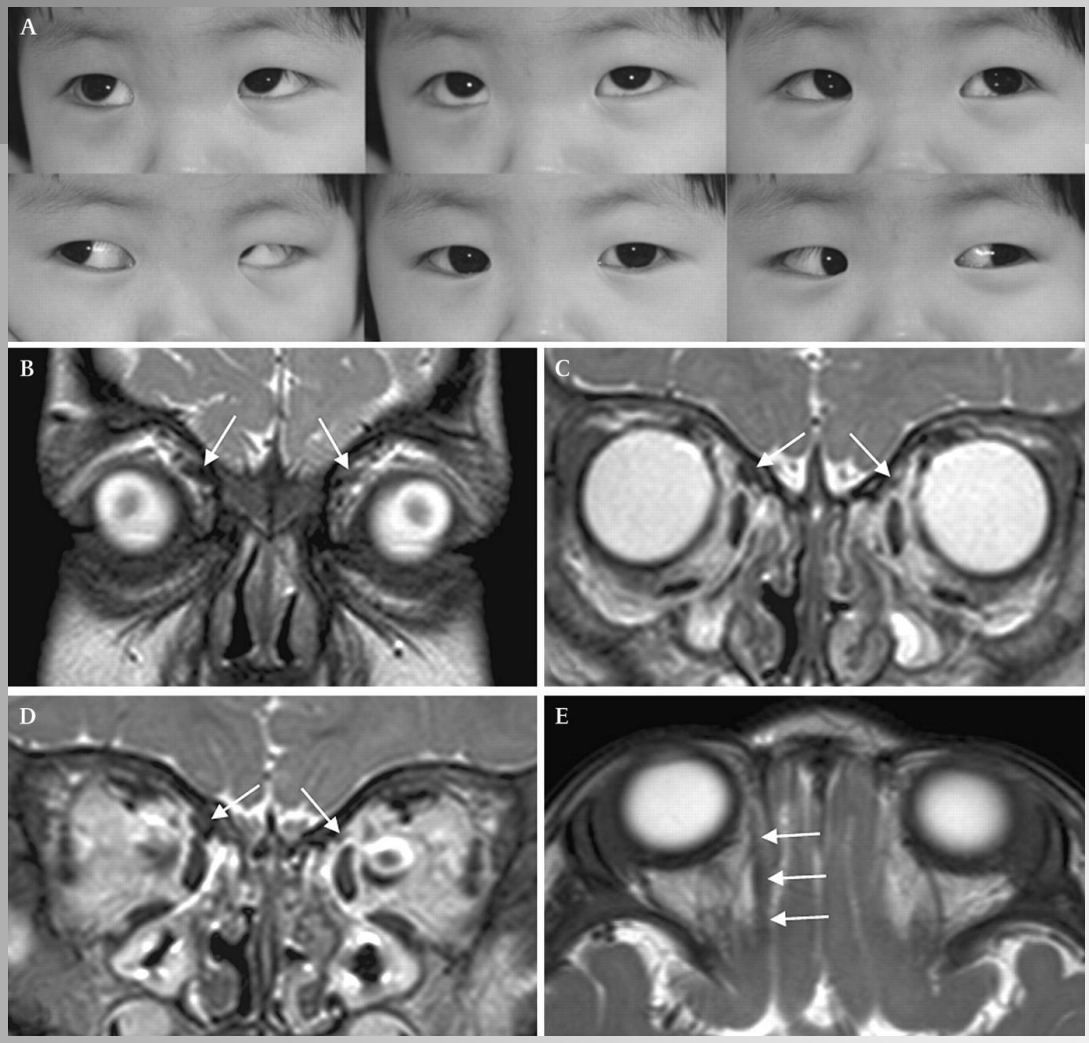
RESULTS



- Moderate to severe hypoplasia of SO (tendon and belly) identified in all 3 cases
  - All other muscles normal

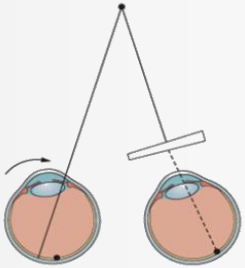
SUPERIOR OBLIQUE PALSY IN CASE 1.

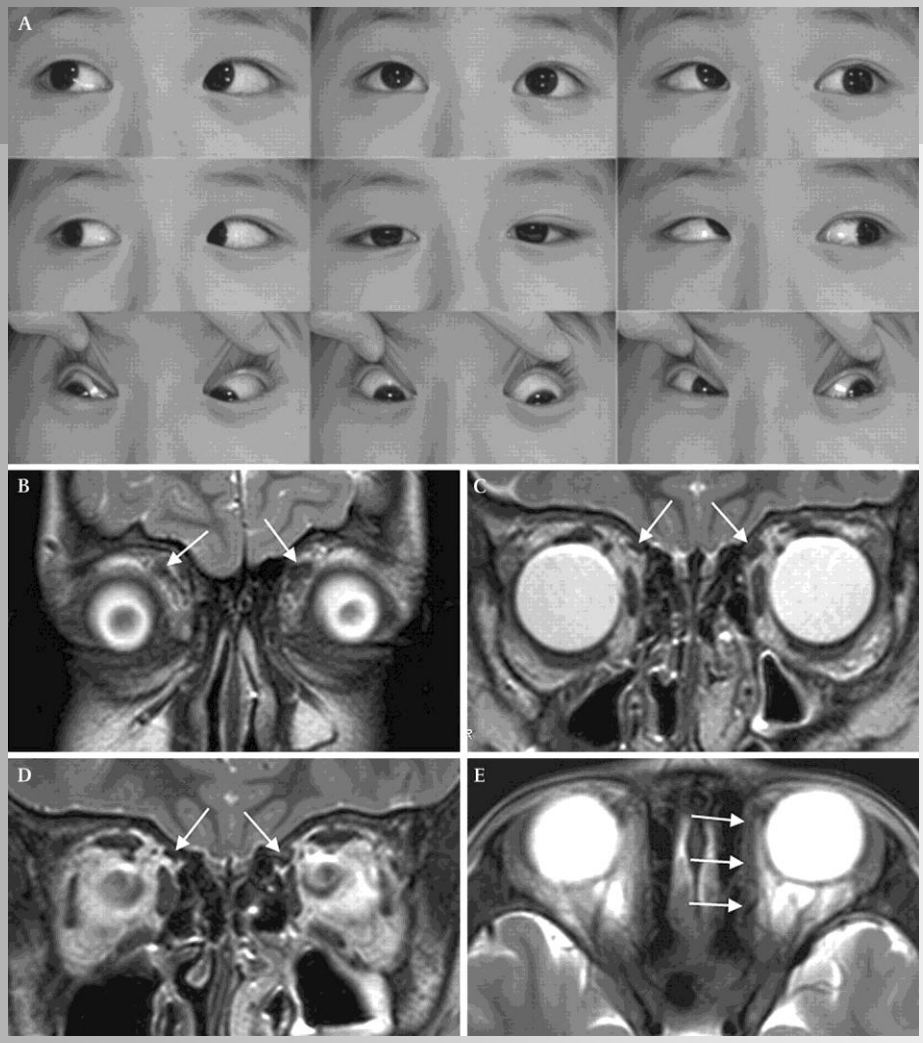




Kim J H , Hwang J Br J Ophthalmol 2010;94:346-350

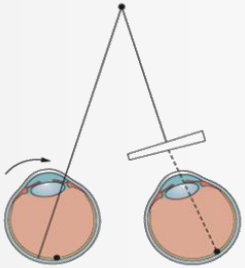
SUPERIOR OBLIQUE PALSY IN CASE 2.

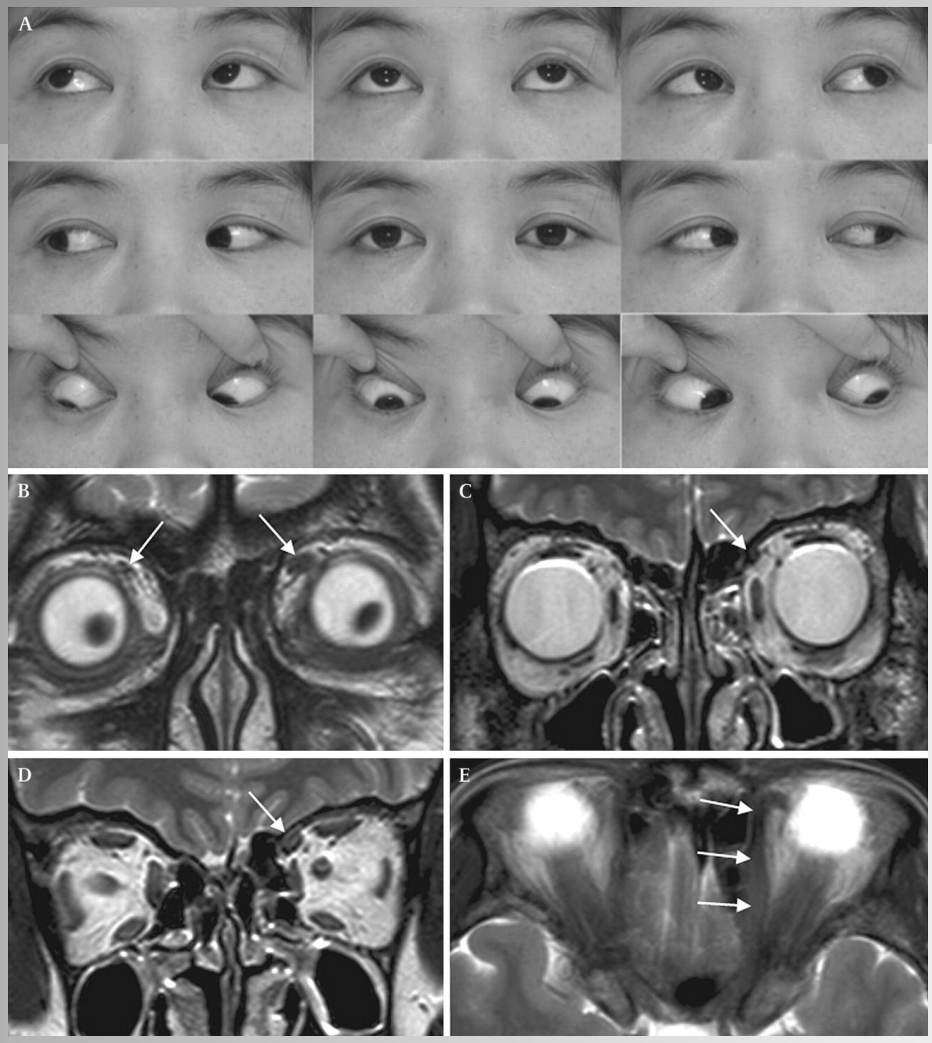




Kim J H , Hwang J Br J Ophthalmol 2010;94:346-350

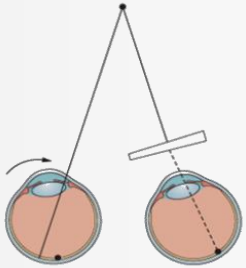
SUPERIOR OBLIQUE PALSY IN CASE 3





Kim J H , Hwang J Br J Ophthalmol 2010;94:346-350

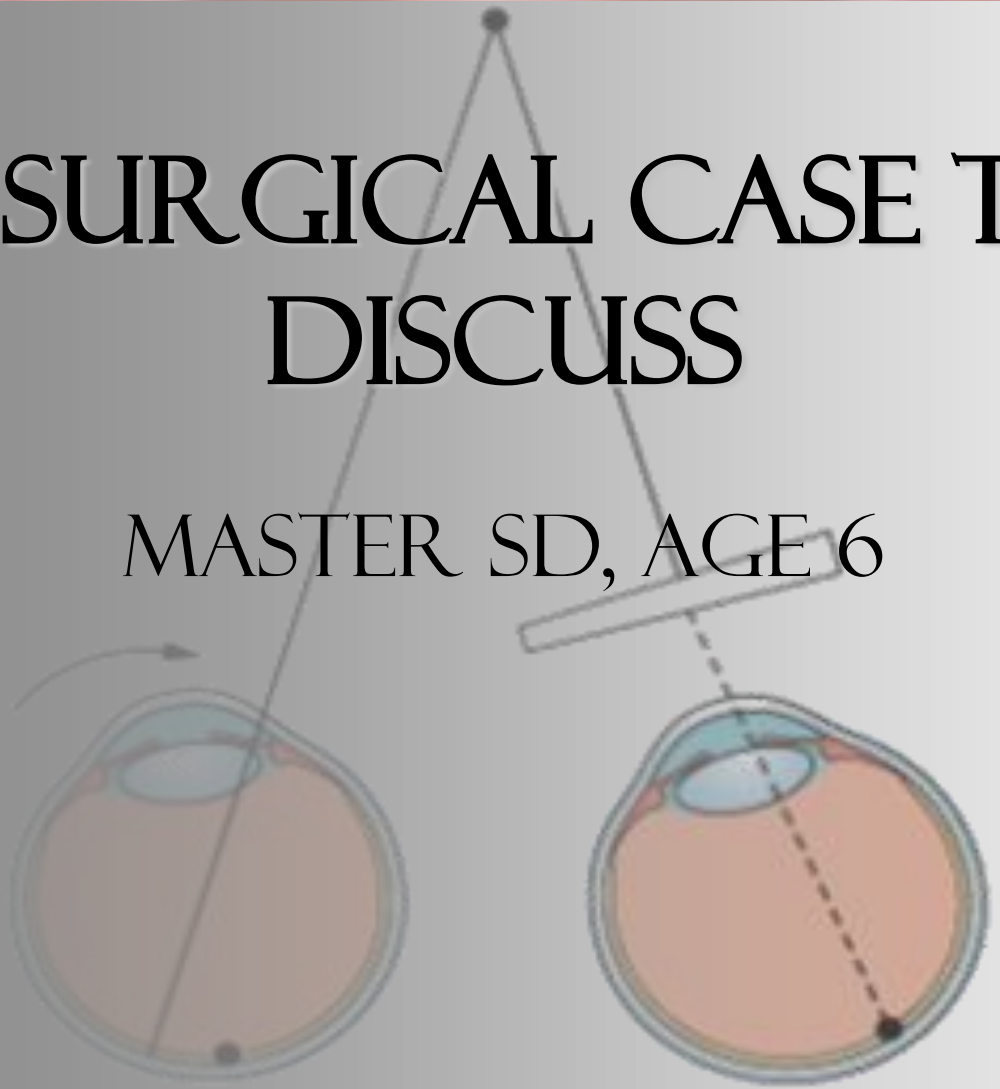
DISCUSSION



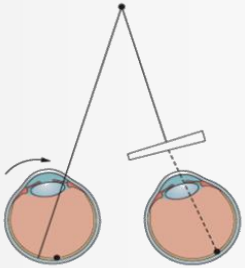
- First description of MR imaging of familial SO hypoplasia
- AD inheritance previously proposed for congenital SO palsy
  - This pedigree may display AD inheritance with incomplete penetrance

A SURGICAL CASE TO DISCUSS

MASTER SD, AGE 6

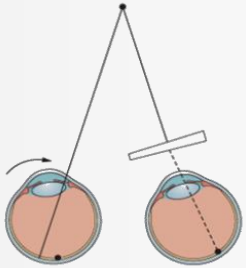


HISTORY



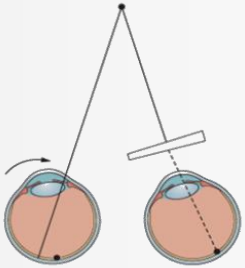
- 6 yr old, underweight Indian boy
- Mother notes LET since age 3-4/12
- PMHx: MVA age 3 – facial paralysis, facial fractures

EXAMINATION



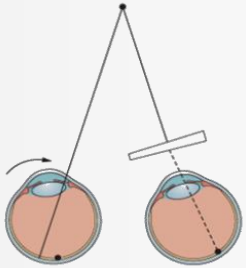
- 10/08
  - Unable to assess VA
  - PCTN 16-18^ LXT, 6^ LHT
  - PCTD 25-30^ LXT, 6^ LHT
  - A pattern
  - Emmetropic, normal fundus

OMC R/V



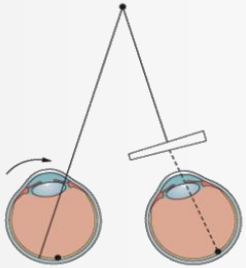
- 12/08
  - LXT ~50%
  - Equal, good VA
  - LHT worse on left gaze
  - RIO underaction
  - [possible R Brown syndrome]

OMC R/V



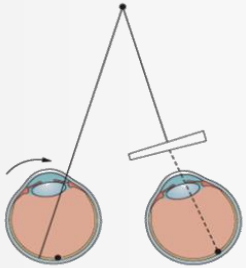
- 1/09
  - PCTN: AXT 40-45^
  - PCTD: AXT 35-40^
  - EOM: R Brown's
  - Trial of +1.5DS lens to see if control improves
- 4/09
  - Glasses no help
  - Bilateral IO underaction noted
  - Again, A-pattern

OMC R/V



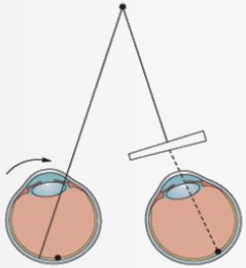
- 6/09
  - Still no amblyopia
    - (Lang consistently negative)
  - Fuses with 12^ prism
  - ?global developmental issues
  - Referred to paediatric neurology
    - No issues

OMC R/V



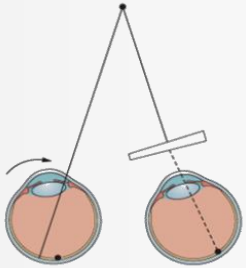
- 3/10
  - No change, no amblyopia
  - PCTN: 10-12^ LXT, 3^ LHT
  - PCTD: 14^ LXT, 5^ LHT
  - Bilateral IO underaction, SO overaction, IR underaction
  - My examination
    - 12^ LHT, 25^ XT, >40^ on downgaze

PLAN?



- ? Diagnosis
  - ?Right / ?Bilateral Brown Syndrome
    - ?should be V-pattern
    - ?XT with Brown's
- ? Management
  - No amblyopia
  - No stereopsis
  - Variable measurements
- Surgery?
  - Would need FDT first
- ? Merit in observation
  - Cosmetic issue
  - Role of orbital imaging?

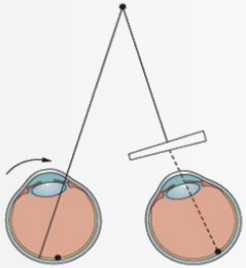
INCONSISTENCY #2 REVISITED



- *BHTT should get less positive over time in SO palsy as IO overaction develops*
  - *It actually gets more positive*

- LIO recruitment in LSO palsy on left head tilt required for anticompensatory torsional saccade (extorsion)
  - As LIO overacts will overpower LIR, giving LHT
  - ?should balance increased LIO action on right head tilt
    - (equalising BHTT)
    - But remember LIO won't elevate above midline when SR inhibited as on right head tilt

INCONSISTENCY #3 REVISITED



- *BHTT should be just as diagnostic for vertical rectus palsies*
  - *It is not*

- Consider LIR palsy
  - BHTT would require LIO to elevate globe in right head tilt to decrease L hypotropia
    - This elevation may not occur due to the weak elevating action of IO alone