Diplopia
Common Causes and Management

Jessica Condie OD, FAAO
March 9th 2014

Overview
- Introduction
- Anatomy/physiology review
- Exam Components
- Conditions/Management
  - Common
  - Uncommon
  - Urgent/Emergent
- Case Review

EOM Anatomy
- 6 Extra ocular muscles
  - Controlled by 3 cranial nerves
    - CN III – SR, MR, IR, IO
    - CN IV- SO
    - CN VI- LR
- Other
  - 7th muscle controls eyelid
    - Levator palpebrae superioris
    - Innervation = Sup CN III

EOM Action Review

<table>
<thead>
<tr>
<th>Muscle</th>
<th>1st Action</th>
<th>2nd Action</th>
<th>3rd Action</th>
<th>Other notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>SR</td>
<td>Elevation</td>
<td>Intorsion</td>
<td>Adduction</td>
<td>Innervation = sup CN III</td>
</tr>
<tr>
<td>MR</td>
<td>Abduction</td>
<td></td>
<td></td>
<td>Innervation = inf CN III</td>
</tr>
<tr>
<td>LR</td>
<td>Abduction</td>
<td></td>
<td></td>
<td>Innervation = CN VI</td>
</tr>
<tr>
<td>SO</td>
<td>Intorsion</td>
<td>Depression</td>
<td>Abduction</td>
<td>Innervation = CN IV Longed CN III</td>
</tr>
<tr>
<td>IO</td>
<td>Extension</td>
<td>Elevation</td>
<td>Abduction</td>
<td>Innervation = inf CN III</td>
</tr>
</tbody>
</table>

EOM Testing
- Range of Motion
- Cover test
  - Unilateral
  - Alternating
- Other
  - Forced Duction
  - EMG: electromyography

Normal Binocular Vision
- Retinal correspondence
- Sensory fusion
- Motor fusion
- Stereopsis
Diplopia
- Due to absence of retinal correspondence
- Visual confusion
- Adaptations
  - Suppression
  - Monocular/alternating/intermittent
  - Abnormal retinal correspondence

Diplopia
- Monocular vs. Binocular
  - Monocular = Cataracts, CME, Bifocal Misalignment, uncorrected refractive error
  - Binocular = Needs further testing
    - Differentials:
      - Binocular vision dysfunction
      - Systemic etiology
      - Cranial nerve abnormalities
        - Palsy
        - Ischemic
        - Trauma

Initial Diplopia Case History
- Monocular/Binocular
- Horizontal/Vertical/Oblique
- Duration/Progression
- Systemic conditions

Initial Diplopia Work-up
- VA’s
- EOM’s
- Alignment evaluation
  - Cover test, Red lens, Maddox rod
- SLE/DFE/BP

Binocular Vision Testing
- Vergences
  - Von Grafe
  - Prism Bar
- NRA/PRA
- Fused cross-cylinder
- MEM
- Stereopsis
- Worth 4-dot

Most Common Vergence Issues

<table>
<thead>
<tr>
<th>Distance &gt; Near</th>
<th>Near &gt; Distance</th>
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</thead>
<tbody>
<tr>
<td>Divergence excess</td>
<td>Convergence Excess</td>
</tr>
<tr>
<td>High XP to (I)XT</td>
<td>EP / (I)ET</td>
</tr>
<tr>
<td>Divergence insufficiency</td>
<td>Convergence insufficiency</td>
</tr>
<tr>
<td>EP / (I)ET</td>
<td>** most common age acquired finding (non-neurologic)</td>
</tr>
<tr>
<td>**XP / (I)XT</td>
<td>**XP / (I)XT</td>
</tr>
</tbody>
</table>
What if ‘Normal’
- Moderate to severe symptomatology
- Normal amount of phoric findings
  - Distance: Ortho to 2XP
  - Near: Ortho to 6XP'
- Best evaluation
  - ** Binocular facilities


Case #1: Case History
- 17 y/o F
- CC: headaches/eyestrain
- HPI: Everyday, worse pm, associated with near work
- PMH/FMH: WNL

Case #1: Exam Findings

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<thead>
<tr>
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<tr>
<td>VA’s</td>
<td>20/20</td>
<td>20/20</td>
</tr>
<tr>
<td>Pupils</td>
<td>PERRL</td>
<td>APD</td>
</tr>
<tr>
<td>EOM’s</td>
<td>FROM</td>
<td>FROM</td>
</tr>
<tr>
<td>CVF</td>
<td>FFC</td>
<td>FFC</td>
</tr>
<tr>
<td>Cover test distance</td>
<td>Ortho</td>
<td>Ortho</td>
</tr>
<tr>
<td>Cover test near</td>
<td>14 XP'</td>
<td>14 XP'</td>
</tr>
<tr>
<td>Retraction</td>
<td>Plano</td>
<td>Plano</td>
</tr>
<tr>
<td>Refraction</td>
<td>Plano</td>
<td>Plano</td>
</tr>
<tr>
<td>Vergence Testing</td>
<td>BO: x/20/14</td>
<td>BI: x/24/20</td>
</tr>
</tbody>
</table>

Case #1: Treatment Options
- **Vision therapy**
  - Pt not interested in weekly visits
  - Declined home based therapy
- **Prism glasses**
  - Reading only
  - Pt preferred this option
- **BV referral**
  - Declined

Prism Calculation
- **Sheard’s Equation**
  - Exophoria
  - For prescribing
    - Prism = 2/3(Demand) - 1/3(Reserve)
      - Demand = phoria
      - Reserve = BO blur

**Our patient:**

\[
\frac{2}{3}(14) - \frac{1}{3}(20) = 2.67
\]

Esophoric prism calculations
- **Percival’s Criteria**
  - BO Prism = 1/3(BO blur) – 2/3(BI blur)
- 1:1 prescribing
  - BO Prism = (Cover test – BI Recovery) / 2
  - Typically split the prism equally OU
Case #1: Trial lens
- Placed 1.5 BI OU
- Initial CT:
  - 10 XP‘
- 15 min after continuous near
  - 10 XP‘
- SRx released for NVO

Case #1: 6 week f/u
- Pt wears glasses at home doing homework
- Reports improved asthenopia, (-) diplopia
- Will monitor yearly

Treatment for Vergence Disorders
- Pediatric
  - Best correction
  - Orthoptics/surgical
  - Prism
- Adults
  - Best correction
  - Prism
  - Surgical/orthoptics

At-home/Computer Therapy
- In office therapy > Computer
- Computer > Pencil push-ups/nothing
- Example
  - http://www.computerorthoptics.com/
  - 14 minutes per day
  - Follow-up: every 6 weeks

Testing for Misalignment
- Gross Evaluation
  - Corneal light reflex
    - Hirschberg/Kappa
      - 1mm = 15-22 δ
  - Krimsky
    - Place prism in front of fixing eye
    - Increase strength until reflex centers
  - Red reflex test/Bruckner
    - White reflex = strabismus/significant refractive error difference

Testing for Misalignment

- Cover test
  - UCT
  - ACT
  - 9 DAF
- Parks 3 Step
  - Hypertropia
- Double maddox rod
  - Torsional
- Red lens test

Parks 3 Step aka Bielschowsky Test

- First, Determine which muscles are under acting
  - I.E. - Right hyper... either the R.E. inferior muscles are not pulling the eye down, or the L.E. superior muscles are not pulling the eye down.

- Next Determine If the hyper worsens in right or left gaze
  - I.E. - If the Hyper worsens in left gaze (right head turn) we circle the muscles responsible for left gaze.

Parks 3 Step, Cont...

- Finally, we circle the head tilt that worsens the hyper
  - I.E. - If the head tilt worsens when tilted to the right shoulder we make a circle in that direction.

***Which ever muscle has three circles touching it is the paretic/underacting muscle, therefore the above example would be a RSO Palsy.

Don’t forget, this patient will most likely walk in with a left head tilt... “always trust the tilt!”

Parks 3 Step Example

- 20 Δ L Hyper in primary gaze
- 10 Δ L Hyper in Left gaze (right head turn), 30 Δ L Hyper in Right gaze (left head turn)
- 15 Δ L Hyper with R head tilt, 40 Δ L Hyper with L head tilt

Solution = Left Superior Oblique Palsy

Double Maddox Rod Test

Evaluates patient for excyclotorsion

Possible Patient Responses

- If the patient reports the lines are parallel, there is no excyclotorsion
- If the patient reports the lines are not parallel, rotate the trial frame axis until the lines are parallel. Greater than 10° of rotation is a positive test.

Strabismus

- Ocular misalignment
  - Non-corresponding retinal points
  - Disrupts binocularity
- Comitancy
  - Comitant
    - Magnitude consistent in all gazes
  - Non-comitant
    - Magnitude varies in different gazes
Comitant Deviations

<table>
<thead>
<tr>
<th>Strabismus</th>
<th>Direction</th>
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<tbody>
<tr>
<td>Esotropia</td>
<td>Basic ET</td>
</tr>
<tr>
<td></td>
<td>Acute ET</td>
</tr>
<tr>
<td></td>
<td>Sensory ET</td>
</tr>
<tr>
<td></td>
<td>Divergence insufficiency [ET]</td>
</tr>
<tr>
<td></td>
<td>Convergence insufficiency [CI]</td>
</tr>
<tr>
<td></td>
<td>Basic XT</td>
</tr>
<tr>
<td></td>
<td>Divergence excess (DE)</td>
</tr>
<tr>
<td>Exotropia</td>
<td></td>
</tr>
</tbody>
</table>
Unique Forms of Strabismus

- Brown’s Syndrome (can be bilateral)
  - Inability to elevate while in Adduction
  - Sup oblique tendon obstruction

- Treatment
  - Symptomatic
    - Prism
    - Monitor
  - Surgical – if torticollis/improved binocularity

1° vs. 2° Deviations - Paresis

- Primary
  - Deviation angle with functioning eye fixating

- Secondary
  - Deviation angle with paretic eye fixating

- Hering’s Law
  - Secondary angle > primary angle

Symptomatic Strabismus

- Intermittent
  - Diplopia when deviation present

- Acquired
  - Decompensated phoria
  - Cranial nerve palsy
  - Other systemic etiology

Acquired Vertical Strabismus

- CN III
- CN IV
- Decompensated congenital
- Post-trauma
- Ischemic
- Acute acquired (CVA, mass)
- Other
  - Skew, Myasthenia, Graves

Management

- Best Correction
- Patching/Medical therapy
  - PEDIG Review
- Orthoptics
- Surgical evaluation

Management, cont...

- Temporary Support
  - Occlusion
  - Fresnel Prism
  - Injections
    - Botox®
Black Pupil Contact Lens

- Temporary occlusion
  - Concern over cosmesis
  - Low Dk/t
  - Daily lens wear
- Order dim pupil size + 0.5 mm

Systemic Causes for Binocular Diplopia

- Thyroid - The “can cause everything” diagnosis
  - Anytime you suspect thyroid disorder TSH/T3/Free T4
  - Forced duction test will be (+) in most cases (due to EOM infiltration, most often IR)
- Autoimmune - Variable and transient symptoms
  - Ocular myasthenia gravis - order Anti AchR, anti-striated muscle test, single fiber EMG
  - Dyspnea/Dysphagia/SOB = ER immediately
- Ischemia - Must r/o GCA in older patients
  - Immediate ESR and CRP

Cranial Nerve III Palsy

- Ptosis
- Down/out eye
- Pupil dilation

- Patients may not complain of diplopia until the upper lid is elevated if a complete ptosis is present

Ischemic CN III Palsy

- **PUPIL SPARING
- Ischemic Risk factors
  - Diabetes
  - Hypertension
- Treatment: Supportive
- Follow-up
  - Monthly until resolution/stability

If an ischemic CN III fails to improve within 3 months, or begins to worsen at any point, it needs further evaluation.
Aneurysm/Neoplasm CN III
- Pupils typically affected
- Worsens over time
- EMERGENCY: Pupil affected CN III palsy along with the worst HA of their life *** Impending Aneurysm***

Treatment
- Refer for Neuro consult
- Supportive once stable (if needed)

Cranial Nerve IV Palsy
- Patients CC: **Oblique Diplopia**
- Isolated CN 4 palsy most often congenital or traumatic etiology.
  - Typically have a head tilt to OPPOSITE shoulder
  - Many congenital cases will decompensate in 5th-6th decade of life
    - Consider Vertical Vergence testing or double Maddox rod
  - Acquired cases; evaluate patients with a park's 3 step test.

Cranial Nerve VI Palsy
- Nuclear palsy causes an ipsilateral horizontal gaze palsy.
- Most often due to ischemic events in elderly patients
  - Monocular palsy
- In kids
  - Post-viral infection
  - R/o neoplasm and increased ICP.

Cranial Nerve VI Palsy
- Patients typical chief complaint: **Horizontal diplopia**
- Presentation:
  - Esotropia in primary gaze
  - Limited/absent Abduction

Case #2
- CC: Sudden onset diplopia
  - 3 days ago
  - (+) trauma (fell down stairs) – (+) LOC
  - (+) horizontal diplopia
  - Constant
  - Worse in right gaze
- POH/PMH: unremarkable

Case #2: EOM's
- VA= 20/20 OU
- CVF= FTFC OU
- Pupils = PERRL (-) APD
- CT= 26CET A in 1° gaze
Case #2: Forced Duction Testing

Case #2: CN VIII

Case #2: Week 1 f/u

Case #2: CT Results

Case #2: Case #2 – 1 week f/u

Case #2: Week 1 f/u
Case #2: 6 week f/u

- +/- diplopia with prism/without prism
- CT =16 CRET-D and 6 PD EP’

Plan: Release 12A BO OD/ 7A BO OS, RTC 1 mo for f/u.

Case #2: 3 month f/u

- (-) Diplopia
- CT: Dist= ortho Near= 4EP’

Assessment: CN VI palsy 2 to trauma-resolved

Plan: Discontinued Fresnel prism. Monitor in 6-12 months

Multiple CN’s Affected

- Cavernous sinus syndrome: lesion in either the Cav sinus OR the SOF [superior orbital fissure]
  - Patient presents with: peri orbital pain, ipsilateral EOM paresis, sensory loss along V1 and V2
  - ***EMERGENCY – must r/o ICA aneurysm, Cavernous Carotid Fistula, Tolosa-Hunt [Granulomatous inflammation] and a nasopharyngeal carcinoma***

- Orbital Apex Syndrome — Looks like a Cav sinus syndrome, but CN II also involved [VF changes-swollen ONH’s]

Variable Diplopia

- Myasthenia Gravis – usually worst in the evening
  - Intermittent symptoms
  - Age of onset
    - Women – 2nd to 3rd decade of life
    - Men – 6th to 7th decade of life

- Decompensated Phoria
  - Typically purely horizontal, without associated lateral gaze restrictions

Observe vs. Image

- Isolated?
  - Traumatic?
    - Neuroimage & further evaluate
  - Congenital?
  - Observe
  - Vasculo-pathic?
  - Progressive or not improved
  - Neuroimage & further evaluate
- Non-isolated?
  - Traumatic?
    - Observe
    - Neuroimage & further evaluate
  - Congenital?
    - Observe
  - Vasculo-pathic?
    - Progressive or not improved
    - Neuroimage & further evaluate
Myasthenia Gravis

- Autoimmune attack of acetylcholine receptors
  - Associated with thymoma (thymus gland tumor)

- Ocular and Systemic Components
  - 90% will have ocular findings at some point
  - Many begin as OMG (ocular)
    - Some convert to GMG (generalized) within 2 years
    - Goal = to prevent conversion
  - (+) Systemic involvement, must R/O: SOB, trouble talking/swallowing

- Clinical Findings
  - Cogan’s lid twitch
  - Improvement with
    - Ice pack
    - Rest
  - Worsening by (AKA enhancement)
    - Elevating the contralateral eyelid
    - Prolonged up look

- Clinical Findings (cont)
  - Transient ptosis
  - With/without painless ophthalmoplegia
  - Variable findings
    - Magnitude
    - Direction

Myasthenia Gravis

Diagnosis

- Blood work
  - Anti-AchR
  - MuSK

- Single fiber electromyography (EMG)

- Chest X-ray/Chest CT

Treatment

- Oral Prednisone
  - Esp. when OMG

- Oral acetylcholinesterase inhibitors

- Lid crutches/Sx
  - For persistent ptosis

Case #3

- 67 y/o M

- CC: Diplopia with mild ptosis

- Began 1 week ago

- Comes & goes

- Switches OD/OS

- PMH: HTN x 9yrs, A-fib, and High Cholesterol

- Medications: atenolol, simvastatin, niaspan, and coumadin

Case #3: Exam findings

<table>
<thead>
<tr>
<th>OD</th>
<th>OS</th>
</tr>
</thead>
<tbody>
<tr>
<td>VA’s (Best corrected)</td>
<td>20/20</td>
</tr>
<tr>
<td>Pupils</td>
<td>PERRL (+) APD</td>
</tr>
<tr>
<td>EOM’s</td>
<td>FROM</td>
</tr>
<tr>
<td>CVF</td>
<td>FFC</td>
</tr>
<tr>
<td>Cover test distance</td>
<td>(+) Phor (MRD = 3mm)</td>
</tr>
<tr>
<td>O/E</td>
<td>WNL</td>
</tr>
</tbody>
</table>
Case #3: MRD Testing
- **MRD = Marginal reflex distance**
- 2 mm difference/change = significant

Case #3 Cogan’s Lid Twitch

Case #3 Prolonged Upgaze

Case #3 Ice Pack Test

Case #3
- Pt referred to Neurology
  - Treated with oral Pyridostigmine bromide
  - The diplopia resolved and the ptosis was greatly improved
- Blood work
  - (+) elevated Ach-R
- Pt Dx = Ocular Myasthenia gravis

Diplopia Review
- **Type of diplopia**
  - Monocular/Binocular
- **Determine etiology**
  - Laterality
    - Binocular
    - Monocular
  - Directionality
    - Vertical
    - Horizontal
    - Oblique
  - Distance affected
    - Distance = Abduction issue
    - Near = Adduction issue
Diplopia Review

- Case history components
  - Onset
  - Duration
  - Other key questions
    - +/- headache
    - +/- Head turn/tilt
    - +/- Proximal weakness
    - +/- Strab/ocular surgery
    - +/- Other neurologic symptoms

- Exam findings to note
  - +/- Vision changes
  - +/- Ptosis
  - +/- Proptosis
  - +/- Pupil involvement
  - +/- Optic nerve involvement

Diplopia Review

- Exam Components
  - VA’s
  - EOMS
    - Ductions
    - Versions
  - Cover test
  - Comitancy testing

- Treatment options
  - Supportive
    - Occlusion
    - Tape on lens
    - Black pupil CL
  - Orthoptics
    - In-office
    - Home/Computerized
  - Surgical
    - Prism
    - Fresnel
    - Ground-in

Take Home Points

- Most common causes of diplopia
- First line treatment
- Conditions requiring emergent/urgent referral
- When to consider surgical evaluation

Clinical Case Review

- Please feel free to ask questions as we go through a few case examples...

Case #1 – 2/2013

- 14 y/o F
- CC: Blurry vision
  - Relief with glasses
  - (-) BV symptoms
  - "Pt denies eye strain or frontal HA's"
- PMH:
  - 6 weeks premature (6 lbs), (-) O2 at birth, normal developmental milestones
### Case #1: Exam Findings 2013

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<td>APD</td>
</tr>
<tr>
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<td>FROM</td>
</tr>
<tr>
<td>CVF</td>
<td>FTFC</td>
<td>FTFC</td>
</tr>
<tr>
<td>Cover test distance</td>
<td>Ortho</td>
<td>Ortho</td>
</tr>
<tr>
<td>Cover test near</td>
<td>8 XP</td>
<td>8 XP</td>
</tr>
<tr>
<td>Refraction</td>
<td>-4.75 sph</td>
<td>-4.75 -1.50 x 175</td>
</tr>
<tr>
<td>Vergence testing</td>
<td>Convergence x/&gt;45 (prism bar)</td>
<td></td>
</tr>
</tbody>
</table>

### Case #1 – 2/4/2014
- 15 y/o F – presents to ER
- CC: Double vision
  - Not currently present
  - Began 1 week ago
  - binocular
  - occurs 1x/week ~ 1 hour in duration
- PMH/FMH:
  - H/o migraine headaches

### Case #1: ER Exam Findings 2/4/2014

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<td>APD</td>
</tr>
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<td>EOM’s</td>
<td>FROM</td>
<td>FROM</td>
</tr>
<tr>
<td>CVF</td>
<td>FTFC</td>
<td>FTFC</td>
</tr>
<tr>
<td>SLE</td>
<td>WNL</td>
<td>WNL</td>
</tr>
<tr>
<td>Non-dilated R0</td>
<td>0.45/0.45, healthy</td>
<td>0.45/0.45, healthy</td>
</tr>
</tbody>
</table>

**Plan:** Refer to BV for further evaluation

### Case #1 – BV Exam 2/10/2014
- 15 y/o F
- CC: Double vision
  - Now associated with headache
  - Became constant
  - binocular
  - (+) tinnitus
- PMH/FMH:
  - H/o migraine headaches

### Case #1: BV Exam Findings 2/10/2014

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<td>FROM</td>
</tr>
<tr>
<td>CVF</td>
<td>FTFC</td>
<td>FTFC</td>
</tr>
<tr>
<td>Cover test distance</td>
<td>20 CLET/10 LHyperP</td>
<td></td>
</tr>
<tr>
<td>Cover test near</td>
<td>20 CLET/10 LHyperP</td>
<td></td>
</tr>
<tr>
<td>Refraction</td>
<td>-4.75 sph</td>
<td>-4.00 -2.25 x 175</td>
</tr>
<tr>
<td>Worth 4 dot</td>
<td>5 dots, 4 dots with -10 BU/20BO - OD</td>
<td></td>
</tr>
</tbody>
</table>

### Case #1 – Optic Nerve Photos

![ONH OD](image)

![ONH OS](image)
Case #1

ONH OCT

Notes: when a patient is under 18 y/o, there are no age matched normal reference ranges.

Case #1 – ONH 5 Line Raster

Case #1 – Neuro Exam 2/11/2014

- 15 y/o F
- CC: Double vision
  - Now associated with headache
  - Became constant
  - Binocular
  - (+) tinnitus
- PMH/FMH:
  - H/o migraine headaches

Case #1 – Neuro Exam Findings 2/11/2014

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<td>FROM</td>
</tr>
<tr>
<td>CVF</td>
<td>FTFC</td>
<td>FTFC</td>
</tr>
<tr>
<td>DFE</td>
<td>(+) Papilledema</td>
<td>(+) Papilledema</td>
</tr>
</tbody>
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Assessment: Papilledema - Presumed LH OU

Plan: Refer for MRI/MRV with LP. To Neuro at UIC for follow-up.

Case #2

- 14 y/o F
- CC: Occasional diplopia
  - Began with bump on eyelid
  - Worse at end of day
- PMH: Unremarkable
Case #2: Exam Findings

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<td>20/20</td>
</tr>
<tr>
<td>Pupils</td>
<td>PERRL - APD</td>
<td>PERRL - APD</td>
</tr>
<tr>
<td>EOM's</td>
<td>FROM</td>
<td>FROM</td>
</tr>
<tr>
<td>CVF</td>
<td>FTFC</td>
<td>FTFC</td>
</tr>
<tr>
<td>Cover test distance</td>
<td>Ortho</td>
<td>Ortho</td>
</tr>
<tr>
<td>Cover test near</td>
<td>14 X^0</td>
<td>14 X^0</td>
</tr>
<tr>
<td>Refraction</td>
<td>Plano</td>
<td>Plano</td>
</tr>
<tr>
<td>Vergence testing</td>
<td>BO: +/-35/30 (exophopter)</td>
<td>BO: +/-35/30 (exophopter)</td>
</tr>
<tr>
<td>NRA/PRA</td>
<td>+1.75/-1.25</td>
<td>+1.75/-1.25</td>
</tr>
</tbody>
</table>

Case #2

- SLE:
  - (+) large chalazion - ULL

- Assessment:
  1. Chalazion
  2. Convergence insufficiency

- Plan:
  1. Refer for removal
  2. RTC post chalazion removal for f/u

Case #2 – 1 month f/u

- CC: Resolved diplopia
- Exam findings: consistent with previous
- Plan:
  - Asymptomatic CI – monitor as needed

Case #3: Initial Exam Findings

<table>
<thead>
<tr>
<th></th>
<th>OD</th>
<th>OS</th>
</tr>
</thead>
<tbody>
<tr>
<td>VA's (Best corrected)</td>
<td>20/20</td>
<td>20/20</td>
</tr>
<tr>
<td>Pupils</td>
<td>PERRL - APD</td>
<td>PERRL - APD</td>
</tr>
<tr>
<td>EOM's</td>
<td>FROM</td>
<td>FROM</td>
</tr>
<tr>
<td>CVF</td>
<td>FTFC</td>
<td>FTFC</td>
</tr>
<tr>
<td>Cover test distance</td>
<td>25 IMT (~90%)</td>
<td>25 IMT (~90%)</td>
</tr>
<tr>
<td>Cover test near</td>
<td>25 IMT (~90%)</td>
<td>25 IMT (~90%)</td>
</tr>
<tr>
<td>Refraction</td>
<td>Plano</td>
<td>Plano</td>
</tr>
<tr>
<td>Stereo</td>
<td>[-] Forms [-] Randot</td>
<td>[-] Forms [-] Randot</td>
</tr>
<tr>
<td>LE/DRE</td>
<td>WNL</td>
<td>WNL</td>
</tr>
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</table>

Case #3: Strab Consult

<table>
<thead>
<tr>
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<th>OD</th>
<th>OS</th>
</tr>
</thead>
<tbody>
<tr>
<td>VA's (Best corrected)</td>
<td>20/20</td>
<td>20/20</td>
</tr>
<tr>
<td>Cover test distance</td>
<td>35 CRST</td>
<td>20/20</td>
</tr>
<tr>
<td>Cover test near</td>
<td>40 CRST</td>
<td>40 CRST</td>
</tr>
<tr>
<td>Worth 4 Dot</td>
<td>Near = 4 dot</td>
<td>Int = 3/2</td>
</tr>
<tr>
<td>Dist = 3</td>
<td>Dist = 3</td>
<td></td>
</tr>
</tbody>
</table>

Case #3: Strab Consult

CT's in 9 diagnostic action fields (near)

<table>
<thead>
<tr>
<th></th>
<th>35 CRST</th>
<th>35 CRST</th>
</tr>
</thead>
<tbody>
<tr>
<td>35 CRST</td>
<td>35 CRST</td>
<td></td>
</tr>
<tr>
<td>40 CRST</td>
<td>40 CRST</td>
<td></td>
</tr>
</tbody>
</table>

*Eye turns most of the time, diplopia only occurs occasionally*
Case #3: Strab Consult

- **Assessment:**
  - Basic ET

- **Plan:**
  - Bilateral MR recession
  - Risks
    - Persistent diplopia
    - Multiple surgeries

Case #3: Surgical f/u

- Pt happy with cosmesis
- (+) rare diplopia – relief with multiple blinks
- CT: 6-8 CRET dist and near
- W4D: (+) RE suppression at all distances

Case #4

- 12 y/o M
- CC: Blurry vision
  - Lost glasses (1 yr ago)
  - (+) double vision/trouble keeping place - @near
- PMH:
  - Asthma, albuterol prn
  - Full term birth, normal developmental milestones

Case #4: Exam Findings

<table>
<thead>
<tr>
<th>OD</th>
<th>OS</th>
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</thead>
<tbody>
<tr>
<td>VA’s (uncorrected)</td>
<td>20/40</td>
</tr>
<tr>
<td>VA’s (uncorrected)</td>
<td>20/80</td>
</tr>
<tr>
<td>Pupils</td>
<td>PERR,</td>
</tr>
<tr>
<td>EOM’s</td>
<td>FROM</td>
</tr>
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<td>CVF</td>
<td>FFC</td>
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<tr>
<td>Cover test distance</td>
<td>2 EP</td>
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<tr>
<td>Cover test near</td>
<td>16 RET ~ 20%</td>
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<tr>
<td>Refraction (Dry)</td>
<td>+2.00, -0.50 x180</td>
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<tr>
<td>Dry refraction cover test</td>
<td>Ortho/Ortho</td>
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</table>

Case #4: Exam Findings

<table>
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<th>OS</th>
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</thead>
<tbody>
<tr>
<td>VA’s (Dry)</td>
<td>20/20</td>
</tr>
<tr>
<td>Max plus to 20/40</td>
<td>+4.00</td>
</tr>
<tr>
<td>Cycloplegic Ret</td>
<td>+6.00, -0.50 x180</td>
</tr>
<tr>
<td>Cyclo cover test</td>
<td>Ortho/Ortho</td>
</tr>
<tr>
<td>Final Sx</td>
<td>+2.00, -0.50 x180</td>
</tr>
<tr>
<td>+1.50 Add</td>
<td></td>
</tr>
</tbody>
</table>

- **Assessment**
  1. Accommodative Esotropia OU

- **Plan**
  1. Release FTW SRx, RTC 6 weeks after wear for follow-up

Case #4: Exam Findings

- Pt broke glasses 1 week after receiving
- Discussed options with mother
  - She chose to fit multifocal CL’s
    - Fit Biofinity multifocal
      - OD: +2.00/+1.50 N
      - OS: +1.50/+1.50 D
- Acceptable vision, good fit – release trials

Case #4 – 6 week f/u
### Case #4 – CL f/u

- Good fit, minimal deposits
- Approve 1 year supply
  - Needs back-up SRx
  - Monitor 3 months (BV f/u)

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<td>VA’s</td>
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<td>20/20</td>
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<tr>
<td>CL cover test</td>
<td>Ortho/Ortho</td>
<td>Ortho/Ortho</td>
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</tbody>
</table>

### Case #5

- 63 y/o F
- CC: Blurry vision
  - + double vision/ghosting
  - Persists with covering OD (monoc OS diplopia)
- POH:
  - LEE: 10+ y/a
- PMH:
  - + HTN – atenolol, lisinopril

### Case #5: Exam Findings

- OD = WNL
- OS = See scan

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<td>FPC</td>
<td>FPC</td>
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<td>Cover test</td>
<td>Ortho/Ortho</td>
<td>Ortho/Ortho</td>
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<tr>
<td>Refraction</td>
<td>+1.00 -0.75 x 88</td>
<td>+1.00 -3.50 x 100</td>
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<tr>
<td>+2.50 Add</td>
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</table>

Pt does not appreciate diplopia with SRx and binocular viewing – does have monocular diplopia if OD covered.

### Case #5

- Pt ed on CL options
  - Pellucid Marginal Degeneration
- Declined at this time
- Release SRx, monitor 1 month

### Questions?

Thank you for your time!