The Optometrist's Guide to Strabismus:
Reorganizing Space, Time and the Visual Process

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Goals of the Course

- Provide a context to help optometrists/vision therapists relate to the world as seen through the eyes of the patient with strabismus
- Explore how patients with strabismus may adopt a modified form of binocularity to match their visual perception of the world with the tactile reality of the world.
- Provide a **therapeutic tool** which can be used to:
  1. Assess the sensory status of the strabismic patient.
  2. Help the strabismic patient re-establish their "binocular software."
- Explore supplementary procedures which support the development of spatial organization and 4-dimensional thinking in patients with strabismus.

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About me

- SUNY grad + VT Residency
- Vision Science, Ken Ciuffreda, mentor
- Independent vision research:
  - Manhattan Vision Associates – functional
  - SUNY-O and SUNY Eye Institute – anatomical, PD
- FCOVD, Bob Sanet, mentor

- Most important: Have been a VT PATIENT at several different stages!
  - Age 6, Age 22, Age 35

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About you?

- Optometrists?
  - Practice VT?
  - Currently working with pts w strabismus?
  - Treat strabismus with lenses/prisms only? In VT?
  - ODs who directly oversee therapy/ patients?
  - ODs who have been VT patients themselves?
- Therapists?
  - With or without OD?
  - Working with patients who have strabismus?
  - Experience as a patient?

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Where to?

- How do we get from A to B?
- It's not enough to know where we are going… we have to know where we are starting from?
- So the most important question at the outset of any program of care is not "Where to?"
  - It's "Where am I?"
    - *(Where are they, visually?)*

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"You can't get there from here."

- Caring for patients with strabismus requires the optometrist to be a *chaperone.*
- We need to escort the patient from point A to point B…
  - or more appropriately, from state A to state B.
- The challenge which most docs face is not landing at state B… but rather, they struggle to find *their* way to state A.

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Relating to your Patient

- When you can identify "where the patient is," you can chaperone the patient from State A to State B:
  - From State A – strabismic processing – a compartmentalized perception of space(s)…
  - To State B – non-strabismic processing – an expanded, integrated, continuous perception of **SPACE,** which is maximally supported with non-strabismic sensorimotor alignment.

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Goals of the Course

- The goal of this 2-day course is to provide the Optometrist/ Vision Therapist with the ability to escort patients with strabismus from state A to state B.
- This requires:
  - An orienting map of "state A"
  - A mindset for "state B"
  - A healthy variety of routes

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Patient Escort Tools:

- An orienting map of "state A":
  - The profile and processing which is common to most patients with strabismus.
    - This applies equally to patients with fragile/ compromised binocularity.
- A mindset for "state B":
  - An integrated model of the visual process which can afford the patient with balance, flexibility, comfort and ease.
- A healthy variety of routes:
  - Activities which *invite the patient to leave state A,* visit state B, and even consider relocating there… permanently.
    - "… Summer Home"

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Outline: A Global Approach to Strabismus

- Thinking in 4 Dimensions: Adaptations
- Patient-oriented Strabismus Assessment
- Visual Projections: Normal and Anomalous
  - Sensory & Motor Assessment (CT, Posture Campimetry, MIT)
- Training with the MIT
  - When, how and whether to address AP…Flow charts
  - Troubleshooting
- Building a 4-D Brain:
  - Harnessing Monocular Depth Cues
  - Multi-sensory integration
  - Visual spatial organization
  - Central-peripheral integration and simultaneous visual processing
- Supplementary material: Vision therapy activities which support 4-D processing

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In the beginning…

- Infants *learn to aim* their eyes in the same direction, with visual experience.
- Strabismus *develops*.
- This is the case *whether or not* the "deck was stacked against the patient"
  - E.g., due to ametropia or poor emmetropization; paretic muscle; gaze palsy, etc.

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THINKING IN 4 DIMENSIONS

THE PRIMARY PURPOSE OF THE VISUAL PROCESS IS TO DIRECT ACTION.

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Learning Objectives

LO's

Participants will be able to:

1. Characterise strabismus as a visual processing problem which impacts the whole person, and is not limited to an "eye-problem."
2. Categorise the processing adaptations which patients with strabismus learn to make in order to cope with the mismatch between the 3-D world as confirmed by touch, and the visual input of mis-aligned visual axes.
3. Explain the "driver/passenger" adaptation as it facilitates appreciation of stereopsis despite an eye posture with misaligned visual axes.

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THINKING IN 3 DIMENSIONS

HUMAN GOAL:

TO SEE THE WORLD **AS** IT IS

Why?

This enables the person to interact with the world in a PREDICTABLE, VISUALLY-GUIDED way!

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THINKING IN *4* DIMENSIONS

HUMAN GOAL:

TO SEE THE WORLD
- **AS** IT IS and
- **WHEN** IT IS

Why?

This enables the person to interact with the world in a DYNAMIC, PREDICTABLE, VISUALLY-GUIDED way!

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Chicken and Egg

- A person with strabismus did not contract a disease … they did not "catch strabismus."
- There is something inherent in how a person functions which caused them to *opt* for strabismus as a solution.
- What are their other options?
- What do they ignore/ attend to in order for strabismus to be the result?

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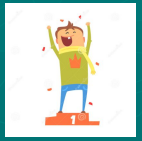
What are the advantages of being Strabismic?

- If a patient makes an adaptation which results in strabismus… rather than an integrated use of the binocular system, it begs the question:
  - What are the advantages of functioning with strabismus?
  - Your ideas??



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Your ideas?

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THINKING IN 4 DIMENSIONS

- The challenge for patients with strabismus:
- In order for the VISUAL INPUT to match the VIEW OF THE WORLD…
  they need to utilize the physiology of the two eye-channels DIFFERENTLY:
  - Separate processing of macula vs periphery
  - Treat the processing of central/peripheral as a CHOICE:

  THE RESULT IS CONFLICT.
- The VISUAL DIRECTION of the two eye-channels may not match…

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THINKING IN 4 DIMENSIONS

- ADAPTATIONS for USING TWO EYES which do not point in the same direction:
  1. **Driver/Passenger**
  2. **Avoid Confusion**
  3. **Ignore the problem**
- Any of these solutions may be available, in whole or in part, to the *same* patient, at any time!

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Strabismic Processing Tools

1. **Driver/Passenger:** The visual direction of the "passenger" eye can be synced to the visual direction of the sighting/driving eye.
   - *~ Anomalous Projection*

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Strabismic Processing Tools

2. **Avoid Confusion:** The visual direction of the two foveae need to be "uncoupled" in the brain if both foveae are to be used.
   - *~ Parallel Processing*

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Strabismic Processing Tools

3. **Ignore the problem:** The fovea (or larger area!) of one eye may be **suppressed** as an alternative to remapping the visual direction of the non-favored eye.
   - *~ Suppression*

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Advantages of Strabismus

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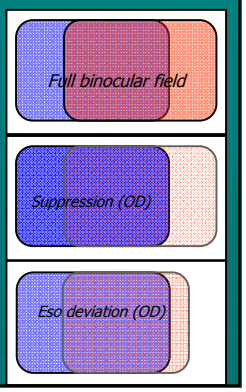
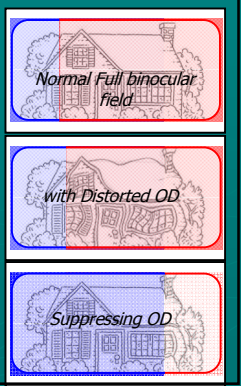
Advantages of Strabismus

1. Reduce the "playing field"
   - Reduce the functional area of the visual field to which a patient diverts energy/ attention
     - By suppression
     - By eso-deviation



Advantages of Strabismus

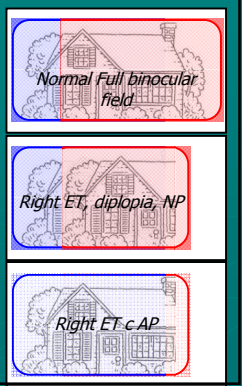
2. Reduces NOISE in the visual input:
   - Repositions/ suppresses the data originating from an eye with reduced clarity (noise)
     - By Suppression
     - By Anomalous Projection



Advantages of Strabismus

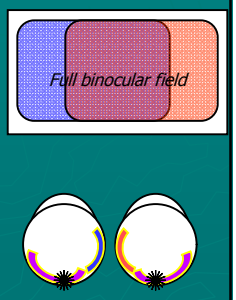
2. Reduces NOISE in the visual input:
   - Repositions/ suppresses the data originating from an eye with reduced clarity (noise)
     - By Suppression
     - By Anomalous Projection (AP)

NP = Normal Projection



Advantages of Strabismus

3. Reduces conflict over the fusible retinal areas (i.e., central & temporal retina)
   - Nasal retina projects to temporal field: monocular visual processing area



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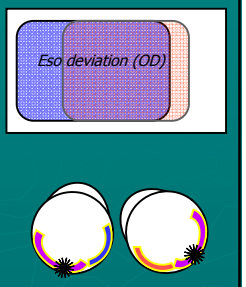
Advantages of Strabismus

3. Reduces conflict over the fusible retinal areas (i.e., central retina & temporal retina)
   - E.g., **Large angle** ETs separate temporal retina by increasing the turn, reducing potential for fusion.
     - Nasal retina projects to temporal field, which is the monocular visual processing area:
     - Brain can process info striking nasal retina OD simultaneously without trying to pair it with info coming from OS.
     - This is why patients with Esotropia often have trouble *relating* information between the two eyes: Information is processed in parallel, but not coordinated.



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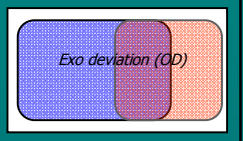
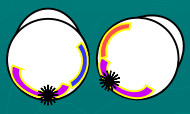
Advantages of Strabismus

3. Reduces conflict over the fusable retinal areas (i.e., central retina & temporal retina)
   - E.g., **Large angle** XTs ALSO separate temporal retina by increasing the turn.
     - Nasal retina projects to temporal field, which is the monocular visual processing area:
     - Brain can process info striking nasal retina OD simultaneously without trying to pair it with info coming from OS.
     - In the case of XT, some of these patients develop "panoramic viewing," and use information from both foveae.





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Advantages of Strabismus

4. When allowing big picture to take priority over details: lowers physiological stress
   - "Let someone else work out the details"
   - Exotropic tendency
5. When allowing details to take priority over big picture: ALSO lowers physiological stress
   - Baby steps… *(…but to where?)*
   - Esotropic tendency

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Advantages of Strabismus

- When enabling driver/passenger system:
  - Suggests difficulty with teamwork;
  - Easier to have a single, clear leader.
  - Role assignment over an area of space, especially in **anisometropes**.
    - *Chicken & Egg!*
- These are indications of a generally stubborn personality type with a clear sense of what they wish to accomplish.
- Such people will need to be convinced *FROM THE INSIDE* of the advantages of an alternate (binocularly integrated, cooperative) mode of function.

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Strabismus

- Strabismus is NOT a DEFECT.
- **It is an alternative organization of an ENTIRE system.**
- Eye misalignment is PART OF THE PROFILE.
  - X-axis misalignment: Eso/ Exotropia
  - Y-axis misalignment: Hyper/hypotropia
  - Z-axis misalignment: Anisometropia
  - *t-axis (time) misalignment: problems with timing and prediction*

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Strabismus is the SYMPTOM

- Expanded definition: Consider the eye misalignment as a SYMPTOM, not necessarily the origin of the problem.
- Therefore, to best address *strabismus* (as with any other condition), we need to treat the underlying problem:
  - Disorganization and confusion in the visual process.

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Strabismus is the SYMPTOM

- Disorganization and confusion is remedied with: **an integrated perspective on the entire, global visual process.**
- Effective treatment requires a behavioral, global approach.
  - Developmental/ performance-based.
- Help the patients become organized, integrated people… in space, and in time.

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break

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Relating to Patients with Strabismus

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Learning Objectives

LO's

Participants will be able to:

1. Describe the purpose of strabismus therapy as helping the patient appreciate global organization, in space and in time. This can be accomplished with activities in which visual information is used to guide movement with both static and dynamic targets (accounting for both spatial and temporal visual information processing).
2. Illustrate how the primary optometric exam findings can be evaluated to better relate to the patient's perspective: Rather than gathering concrete data, explain implications and inferences about visual information processing, based on standard exam data.
3. Analyse prognostic indications of binocular processing by comparing unilateral and alternating cover test findings.

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Strabismus, Time & Space

- This attends not only to appreciation of space and localization, but also to visual *planning* of movement (*time/space*).
- Static and dynamic:
  - Integrate awareness of ***spaces*** of the world into a **continuous space world**…
  - AND, become more accurate in aiming and orientation to ***guide movement*** through space.

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Strabismus, Time & Space

- When orienting self… "Where am I?"
  - to target… "Where is *it?*"
  - …we become most successful when we aim the eyes in a coordinated forward direction:
    - ***to guide forward movement***.
- We also orient to time…
  - "When will I get there?"
  - "When will *it* get *here*?"

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Strabismus Therapy

- Straightening the aim of the eyes is indeed a *by-product* of a successful vision therapy program.
  - Keeping the eyes in a turned posture may be an ingrained habit, somewhat difficult to break.
  - **Biofeedback** which reinforces sensorimotor orientation to the object of regard will help the patient with strabismus re-orient.
    - Reorientation of Self
    - Reorientation of the direction of one's eyes.

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Strabismus Therapy

- Reorientation occurs *in tandem with* a global reorganization in the *processing* of Space:
  - From discontinuous *spaces* in the world…
  - Into a continuous space-world
- This is the Visual Space Solid to which Skeffington referred.

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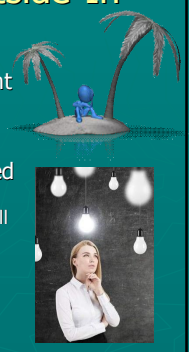
Working from the Outside-In

- Therapeutic plan:
- Work from the outside-in;
- Then help BRIDGE the patient to the goal from *their* inside-out:

"He looks desperate, and I'm pretty sure those rocks spell out the word 'Help.' Maybe we should report this when we finish the round."

Working from the Outside-In

1. Use OEP findings (basic exam) and advanced strabismus diagnostic assessment to identify how the patient is functioning currently.
2. **Envision** how this patient *could* present if s/he were using his/her visual system in a balanced, integrated way.
   - Consider the GLOBAL skills the patient will need to develop and integrate, which will best be facilitated with ***balanced* binocular visual input**.
3. Help the patient BRIDGE THE GAP with activities which provide opportunities for learning and development!



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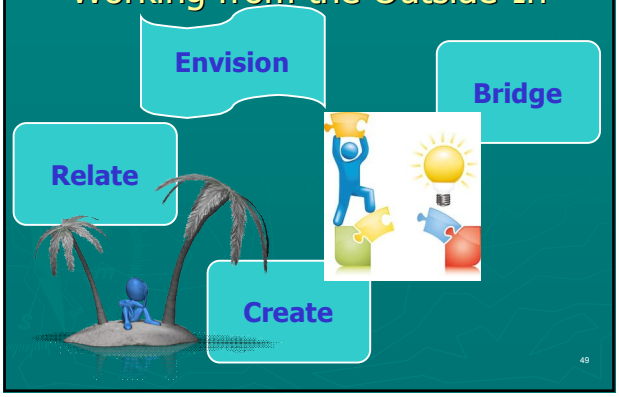
Working from the Outside-In



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Relating to your Patient

- When you can identify "where the patient is," you can chaperone the patient from State A to State B:
  - From State A – strabismic processing – a compartmentalized perception of space(s)…
  - To State B – non-strabismic processing – an expanded, integrated, continuous perception of **SPACE/TIME,** which is maximally supported with non-strabismic sensorimotor alignment.

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You can do it!

- Treatment of strabismus is not about *eyes…*
- *It's about the person, and their perceptions!*
- If you have a clear, integrated understanding of THE VISUAL PROCESS, you can help ANY patient enhance their view of the world, and integrate their compartmentalized sense of /spaces/ into a continuous, dynamic sense of <SPACE/TIME>!

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Relating to Patients with Strabismus:

Case Example: ST

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Case Example: ST

- 24 yo F
- Anisometrope, 2D
- Amps of ~2.5D
- 20/20^{-} OD, 20/20 OS, slow to respond OD, "show again?"
- Zero fusion ranges.
- W4D constant alternation: Initial: 4, then degenerates to 3/2/3/2

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Orthotropia

- Two eyes are aiming in the same visual direction.
- Exceedingly weak fusion.
- *Fragile.*
- Binocular system balanced on a razor's edge.
- Any disruption causes a break down of fusion.
- Development of ANY anisometropia is a clue that binocularity is weak.
  - This adaptation preserves distance acuity while reducing nearpoint stress.
  - Likely the *preferred eye* for cognitive input/ reading is the one developing myopia.
  - Difficulty refracting one eye relative to the other: a very mild amblyopia.
  - Patient is trying to match the (x,y) SPACE of each channel.

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Diagnostics: Assessing the Patient with Strabismus

- *Interpret primary exam (OEP) findings as part of your strabismus assessment*
- *Explore how to use and interpret image projection techniques as part of a diagnostic battery when working with strabismic patient.*
- *The MIT and Brock Posture Board are introduced*
- *FOCUS ON THE **PATIENT**…*
  - *AND THEN **USE** THE DIAGNOSTICS!*

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Diagnostics

- Begin the assessment of a strabismic patient by asking *yourself* what you want (or need) to know.
- Then tailor the optometric exam to answer those questions!

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Diagnostics: Same basic info…

- Acuities
- Refractive State
- Binocularity?
  - Fusion: Degree?
  - Fusion: Range?
  - Motor vs Sensory?
- Peripheral Vision
  - Impacts on fusion (free space vs phoropter)
  - Localization
- Accommodation
- Ocular health/ complicating factors/ trauma(s)
- Must get a comprehensive history

But what do we want to know?

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Problem orienting an Optometric Exam for patients with Strabismus

- Step out of the "routine exam" mode.
- Investigate the patient's perspective.
- Ask yourself questions.
- Answer these questions by collecting optometric data.
- Problem-solve with optometric tools.

Acuities: What we want to know… (WwWtK)

- Can the patient see equally well out of each eye?
  - Now (entrance VA)?
  - Potentially (with compensation)?
- If not, was this a *recent* adaptation since last evaluation?
  - Were they *intentionally* undercorrected?
  - Did the refractive state change?
  - What does this suggest regarding their adaptations?

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Refractive State: What we want to know… (WwWtK)

- What does the refractive status tell us about their development?
  - Tendencies?
    - Hyperopia= create a buffer vs
    - Myopia= drive, over-centering, reduced peripheral attention
  - Adaptations?
    - Anisometropia= driver/passenger, reduced stereopsis
- How will refractive compensation interact with accommodation?
- How will refractive compensation help…
  - At distance?
  - At near?
  - What is the **priority** for helping this patient function best?
    - Better binocularity vs better acuity??

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Binocularity: WwWtK

- Which eye does s/he choose to fixate with?
  - At distance? Near?
- How strong of a preference does s/he have for using the "preferred" eye?
- What happens if s/he fixates with the non-preferred eye?
  - At distance? Near?
- Can s/he alternate voluntarily?
- Does s/he alternate involuntarily?
- How large is the turn? At distance? Near?
  - Does it depend on which eye is fixating?
  - Does s/he demonstrate some use of phoria in his/her natural posture? (Yes → Implies peripheral fusion!)
  - What does *that* tell us about the binocular status?

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Binocularity: WwWtK

- Can s/he fuse?
  - 3rd degree? (Stereopsis)
  - 2nd degree? (flat fusion (FF))
  - 1st degree? (simultaneous perception (SP))
- Can s/he bifoveate? (Random Dot Stereo (RDS))
- How does the degree of fusion vary between free space and phoropter space?
- How much prism compensation is needed for fusion?
  - Free space?
  - Phoropter?
  - Distance? Near?
- Is s/he using peripheral vision? OU?

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Binocularity: WwWtK

- Is there a fusion *range*?
  - Distance? Near?
- How does the range of fusion vary between free space and phoropter space?
- Is s/he *aware of* peripheral stereopsis?
  - Localization?
  - SILO/float?

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Accommodation: WwWtK

- Are amplitudes of accommodation age-appropriate?
  - Symmetric?
- How is accommodative facility?
  - At distance? Is there ***variability during refraction***?
  - At near?
    - Plus acceptance?
    - FCC; UFCC symmetric?
    - NRA, PRA?
    - MEM: Lag/ lead? What does this imply about his/her visual organization? Rapport at near-point?
- How is s/he *using* accommodation?
  - Accommodative convergence?
  - How does this interact with the turn?

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Ocular health/ complicating factors/ trauma(s): WwWtK

- Attend to ocular motilities, incomitancies
- Note any gaze restriction
- Abnormal head posture
  - Head Tilt– vertical deviation? Indicates an adaptation *in support of* fusion
  - Head Turn–
    - Gaze restriction? May have adapted a turn to support (or avoid) fusion.
      → Consider lateral yoked prism.
    - Latent nystagmus? Head turn may be for stabilization

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Comprehensive Case History: WwWtK

- Consider other factors/ life events which may impact potential for fusion
  - Ocular disease;
  - organic reasons for vision loss, central or peripheral.
- Consider other factors/ life events which have interfered with function on the whole
  - "FAT" scan (Family Album Tomography)
  - H/o cancer, trauma, ABI, major illness, diseases with ocular side-effects (e.g., myasthenia gravis), any surgeries in local area (procedures on nose, eyebrows, etc.)

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Interpretaton of data: WwWtK

- What kind of "brain adaptation(s)" might s/he be making?
  - Driver/Passenger?
  - Avoid Confusion?
  - Ignore the problem?
  - Continue seeing diplopia?
- Does s/he employ different strategies at distance & near?
- How is s/he "running her software"- i.e., what combination of adaptations is s/he using?
  - Generally processing the world monocularly?
  - Monocular centrally/binocular peripherally?
  - Is there a stable "ground"? Or does s/he alternate freely?
  - Can s/he alternate **consciously**?
  - Does s/he avoid fusion? What if you change the target?
  - How does a change in context change his/her visual process?

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Behavioral Implications: What we want to know…

- How are the patient's adaptations consistent with his/her personality/ approach to life/ emotional make-up?
- How might changes in these adaptations "upset the apple cart?"
- Taken all together, what is this patient's prognosis for
  - processing binocularly?
  - processing bi-foveally?

Skip case

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Interpreting Primary Exam Findings

- The following case is presented for group discussion and interpretation.
- Compare and contrast the findings.
- These are pieces of a PUZZLE.
- Look for the CLUES that indicate how the patient is processing!

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Patient ST: Case Hx

- 24 yo F
- CC: Diplopia after 5 min of reading.
- Tries to read aloud to keep track.
  - Unable to read for pleasure.
- Reports she makes the images "double enough to see two columns of text, and just read one of them."
- Says this is exhausting. She tries to fight through the reading assignments, but falls asleep after 15 min.

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Patient ST: Case Hx

- Reports that when she tries to simply cover an eye, she feels "**ungrounded**," and her comprehension is worse than if she just reads through the diplopia.
- Managed college by auditory learning, lectures.
  - Was a science major, and the science projects and reports were manageable.
  - Psych classes, she did well enough with the classroom material to perform well without covering the reading material.
  - Reading-intensive classes: Struggle.

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Patient ST: Relevant optometric history

- Wearing CL's: OD -0.75, OS -2.50 sph
- Has reading Rx to wear over CL's:
  - +0.50 sph OU = 1^BD OU
- Had in-office vision therapy as a child for "lazy eye" and poor tracking.
  VT supplemented with directed home VT activities:
  Patching OS, 1 hr/day.
- First glasses = NV Rx at age 5.
- Developed myopia monocularly OS around age 14.
- Anisometropia increased through high school and college.
- Began going myopic OD around age 17.
- Does not have an updated spectacle Rx.

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Patient ST: Relevant optometric history

- Reports unusual event at age 19:
- After intense night of studying, put in CLs the next morning:
  - Powers were -0.50 OD, -2.25 OS.
- "World went tilted."
- Holding the walls to walk down the hall.
- Managed by removing OD lens only: "world went straight again if right eye was not corrected" (i.e., compensated)

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Patient ST: Exam findings

- DVA sc:*
  - 20/100, 80 OD
  - 20/400 OS
  - 20/80, 60 OU
- Current CL Rx:
  - OD -0.75 sph 20/20$^{+/-}$
  - OS -2.50 sph 20/40, 25^{-}
    OU 20/30, 25^{+}
- Near VA c CL:
  - 20/40, 25- OD
  - 20/30, 20 OS
  - 20/40, 30 OU

** VA's: functional, acuity*

- Cover Testing:
  - Dist: ortho, subjective R Hyper
  - Near: UCT: note instability OD, variable.
  - ACT: 6 EP
- NPC: TN
- Repeat c Red Lens (RL):
  - Room lights on: TN
  - Dark room: exo dpl @8" "alternates red/white, one light in front of the other, never really together"

What does this imply about her function?

75

Patient ST: Exam findings

- EOMs: FROM OU
  - NSUCO Pursuits 5 - 4 - 4
  - NSUCO Saccades 5 - 3 - 5
  (ability - accuracy - Head Mvmt)
- AHP (Abnormal Head Posture):
  - Noted head is rarely straight.
  - Varies between:
  - Noticeable turn to right, left eye forward during Hx.
  - Tilt to left when being tested/ listening
- CVF: Full OD, OS
- W4D:
  - @ 40 cm: Initial Flat Fusion (FF), then 3 G with 1 R flickering
  - @ 3 m: Initial FF, then rapid alternation: 3 G/ 2 R/ 3 G/ 2 R... NO LATERAL MOVEMENT DURING ALTERNATION.
- Stereo:
  - (+) RDS, slow
  - Wirt: 70", 40"... 30"
- Maddox Rod (MR) @ Near:
  - Eso projection
  - Mild R hyper

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Patient ST: Exam findings

- Ret:
  - OD -0.75 sph
  - OS -3.00 sph
- Subjective:
  - OD -1.00 sph 20/20$^{+/-}$
    - Slow, hard to decide
  - OS -3.00 -0.25 x 180 20/15
    - Quick & consistent
- Balance:
  - OD -0.75 sph
  - OS -2.75 -0.25 x 180 OU 20/15^{-}
- Complains of HA b/n eyes
- Dist. Phorometry
- VG: 4 eso, 0 vertical
- BO: x/34/3
- BI: x/4/-3
  - No reports of SILO
  - Asked about blur: "maybe right before it went double, not sure"
  - "I just crossed my eyes to keep them together."

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Patient ST: Exam findings

- Near Phorometry
- VG:
  - w/ DV bal: 8 eso, 0 vertical
  - w/ +1.00: 2 eso
- FCC: +1.50, 20/20
- UFCC: +1.75 (V) OD +1.50 OS
- **Base:** +1.50 over balance
- NRA/PRA: +1.00/ -0.25
  - **"Goes double"** on (-).
  - Intermittent dpl at each step
- VG: 1 exo
- BO: x/4, 8, 12, 16, 20/-2
- BI: x/2/-4 "I can bring them back together"
- Repeat Near ranges through **BALANCE** (current CL function)
- BO: x/2, 4, 6, 8/-2
- BI: x/2/-2
- Minus Lens Amplitude
  - OD 2.00 D
  - OS 3.00 D

78

Review findings… your assessments?

- Revisit the problem-oriented strabismus exam series for this case:
  WHAT WE WANT TO KNOW

79

Sensori-motor Diagnostics for Strabismus

How to proceed if your standard testing has not yielded single-and-clear binocular vision

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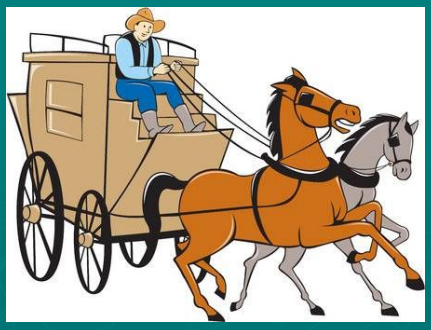
Learning Objectives

LO's

Participants will be able to:

1. Apply visual biofeedback to help all patients (strabismic as well as all others with binocular vision disorders) experience sensory fusion.
2. Describe how the patient can be trained to develop responsibility and control over their visual perception during visual biofeedback exercises which modify the neural pathways between each eye-channel and the visual cortex.
3. Demonstrate adoption of the posture-oriented terms, "eso-" and "exo- diplopia." rather than refer to images as "uncrossed" or "crossed" during dissociative activities, so a source of language confusion is eliminated when switching between image localization activities and image projection activities.

82



83

Sensory Fusion vs Motor Fusion

- Motor fusion: Match the *direction* of the two eyes
- Binocular Motor responses: Converge
  - One can voluntarily converge eyes without matching sensory information between the two eyes
  - Use cross-linked accommodative and convergence systems to achieve convergence when unable to converge voluntarily.
- Sensory fusion: Match the *information* from the two eyes
  - Does not require eyes to point in the same direction: Can utilize prisms to move visual input.

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Sensory Fusion vs Motor Fusion

- Hard part: Obtain sensory fusion.
- Easy part: Create motor fusion (eyes converge and diverge in coordination)
- Strabismus cases work in two major stages:
  - First, create sensory fusion, so the brain learns how to work carefully with info from 2 eyes at the same time.
  - Second, develop motor fusion, to maintain eye alignment in different areas of gaze Near/Far/Up/Down/Left/Right
    - Motor fusion activities are *sensori-motor.*

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Sensory Fusion vs Motor Fusion

- "Easy cases": Sensory fusion already established:
  - Decompensated paretic muscle:
    - Superior Oblique palsy/ stress event.
    - Patient had longstanding sensory fusion and presents with diplopia because he lost motor fusion ability
  - Diabetic palsy (temporary, Lateral rectus denervation: ~20^ Esotropia)
- "Hard cases": Non-symptomatic strabismus

87

Classic vs Behavioral Model

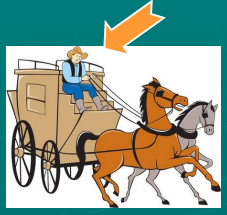
- The classic model is muscle-based: Need to consider where eyes are pointing and how muscles are working, and then redistribute the muscles to change motor output.

Classical model: change the length of the reins

90

Classic vs Behavioral Model

- Behavioral Model: Sensory fusion can take place *regardless of where eyes are pointing* (with the help of prisms/ lenses/ and filters).



Behavioral model: Train the DRIVER!

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Sensorimotor Fusion

- Once sensory fusion occurs, the brain controls modifications to the neural messages reaching each muscle!
- Sensory and motor fusion act in concert!
  - Example of individual who had a trauma: removed one of the six muscles from one eye:
  - Redistribution of NEURAL effort among the remaining muscles. Now holds sensory AND motor fusion without prism.

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Degrees of Sensory Fusion: Review

- 1° Fusion: Simultaneous Perception (SP)
- 2° Fusion: Flat fusion (FF)
- 3° Fusion: Stereopsis

- Worth 4 Dot: Tests 1° and 2° Fusion only

- 3° Fusion (Stereopsis):
  - Arises from retinal image **disparity**.
  - Interpretation of **depth** is based on similar images falling on non-corresponding retinal points.
- Depth **Perception**: "Where is *it* relative to *me*?"
- **Stereopsis uses binocular input to inform depth perception.**

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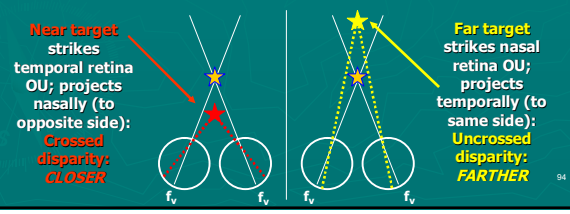
Degrees of Sensory Fusion: Stereopsis

- Stereopsis arises from points in front of or behind the point of regard having crossed or uncrossed retinal disparity (respectively).
  - Within "Panum's fusional area," the object(s) remain single.
  - Beyond Panum's area, diplopia may be experienced *without loss of stereopsis.*



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Sensory Assessment & Training

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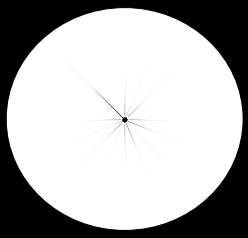
Primary Tool: The "MIT"



96

Let's Experiment!

- Red – Green glasses *or*
- Red – Blue glasses

- Place the RED on the **non-preferred eye**

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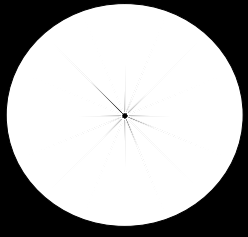

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Interpreting responses with MIT/ Swirl

- *This test set-up allows us to assess **IMAGE PROJECTION***
- Normal Projection (NP) vs Anomalous Projection (AP)
- Other Terms in use:
  Normal (Retinal) Correspondence (NRC or NC)
  Anomalous (Retinal) Correspondence (ARC or AC)

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Projection vs Correspondence

- Projection/Correspondence refers to the relationship of visual information as received by a pair of eyes.
  - "**Projection**" relates the images at the brain level; each image is perceived as originating from a point in space. That point in space may be independent of the retinal locus on which the image fell.
  - "**Correspondence**" relates the two images at the retinal level, on the basis that points on each retina are mapped to specific (corresponding) locations in the brain.
- The names address different notions of what is occurring.
- All terms are still in use clinically.
- Anomalous Projection (AP) is the best current descriptor of the PROCESS.

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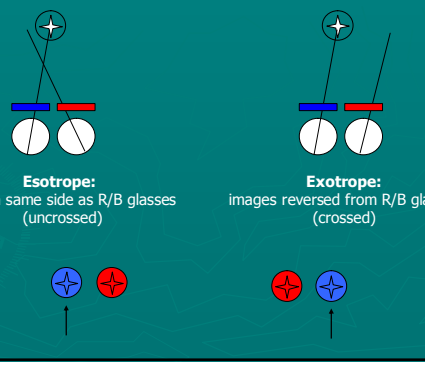
Expected Visual Percept with Strabismic Eye Posture



Esotrope:
images on same side as R/B glasses (uncrossed)

Exotrope:
images reversed from R/B glasses (crossed)

101

Expected Visual Percept with Strabismus: Right ET, NP

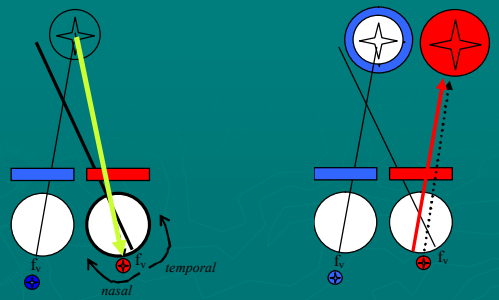


Image strikes nasal retina

Image ***projects*** to temporal side of Right Eye

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Expected Visual Percept with Strabismus: Right XT, NP

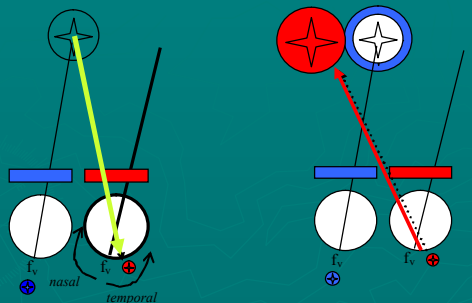

Image strikes temporal retina

Image ***projects*** to nasal side of Right Eye

103

Language, language!

- Familiar terms: crossed, uncrossed
- Points of confusion:
  - crossed eyes/ uncrossed diplopia; vice versa
- Do esotropes always report uncrossed images?
- *Careful: Difference between image localization and image projection.*
  - Single white light source seen through red/greens (MIT)
  - Two lights used as a projection of image location (Hess Screen; Brock posture board)
  - The form of presentation will alter the relative image location!
  - **THEREFORE: I recommend referring to what the RESPONSES indicate:**
    - **i.e., "eso dpl", "exo dpl"** rather than "uncrossed"/ "crossed" *images.*

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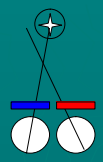
Language, language!

- *Image localization:*
  - Single white light source seen through red/blues (MIT):
    - Crossed eyes with UNcrossed images
    - "ESO DIPLOPIA"
    - NP

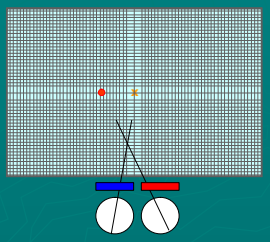


Esotrope: CROSSED EYES / UNcrossed IMAGES ET with Eso diplopia

105

Language, language!

- *Image projection:*
  - Two lights/sources used as a projection of image location (Hess Screen; Brock posture board)
    - Crossed eyes with CROSSED images
    - Still "ESO DIPLOPIA"
    - NP

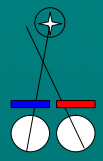


Esotrope: CROSSED EYES / CROSSED IMAGES ET with Eso diplopia

106

Language, language!

- *Image localization:*
  - Single white light source seen through red/blues (MIT):
    - Crossed eyes with CROSSED images
    - "**EXO** DIPLOPIA"
    - AP



Esotrope: CROSSED EYES / CROSSED IMAGES ET with EXO diplopia (AP)

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Refining our language

- First, we need to know **what we would expect** based on binocular posture.
- Refer to perceptions as "eso diplopia" whenever it is the *appropriate perception of over-crossed visual axes*.
- Refer to perceptions as "exo diplopia" whenever it is the *appropriate perception of under-crossed visual axes*.
- This removes the confusion when switching between different modalities of visual probing.
  - MIT (or W4D): provide **one point** seen in **two places.**
  - Hess Screen, Brock Posture Board (Eye projections): provide **two points** seen in **one place.**

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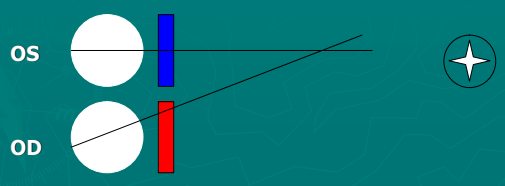
Refining our language

- Reminds us to stay mindful of eye posture ***relative to*** the presented target!
- Example:
  - Create simultaneous perception in a 25^ ET:
  - Apply 45^BO.
  - Patient is now OVERCORRECTED.
  - Their visual axes are now **under-crossed** for the target.
  - Effectively, they are now EXOTROPIC relative to the target.
  - They should report EXO diplopia.
  - (Draw this for yourself!)

109

Self-Quiz:

- How do images project in Hypertropia with NP?
  (stacked side-view, Right Hypertropia)



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Possible AP responses: The "unexpected"

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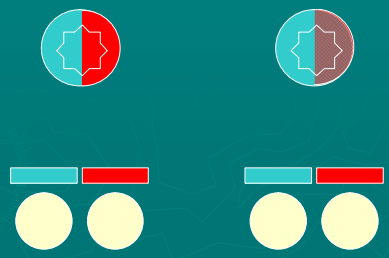
Split Fields



No blending

Partial blending

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Unexpected Visual Percept with Strabismus: Right ET

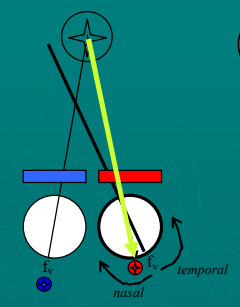

Image strikes nasal retina

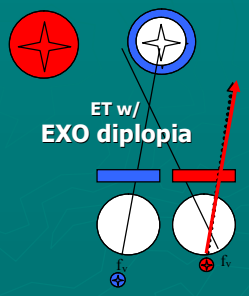

Image ***projects*** to temporal side of Right Eye??

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Unexpected Visual Percept with Strabismus: Right XT

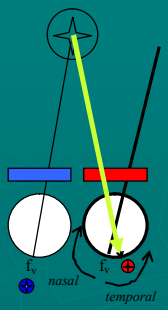

Image strikes temporal retina

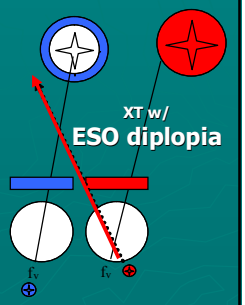

Image ***projects*** to nasal side of Right Eye??

115

Why?

- Your ideas? Hypotheses?
- Patients haven't explored what their eyes are "supposed to do."
- They often assume if their eyes point in a crossed way, their images should be crossed.
- There is a conscious or non-conscious re-assignment of visual space (projection).
- It is a *learned* coping mechanism, which likely makes fixation switches (for alternators) less confusing.
  - Therefore, it can be UNLEARNED
- The midline areas are particularly confusing: often suppress over this zone instead.

116

Telling themselves stories

- Patients with strabismus *tell themselves stories* about how their vision "works."
- These can become self-fulfilling prophecies.
- Examples:
  - "I don't see out of my left eye."
  - "I don't use my left eye."
  - "Whatever I see through my eye (with the right hypertropia) is up and to the right."

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Philosophical/ Clinical Detour*: Telling themselves stories

- *Consider that the assigning of a "real image" and an "unreal image" … which may be a necessary "maneuver" for organismic survival …*
  - *WILL AT THE SAME TIME ENABLE THE CONTINUATION OF **NON-INTEGRATION** OF THE INFORMATION FROM THE **TWO** CHANNELS, AS ONE IS CONSIDERED **REAL** AND THE OTHER **NOT REAL**…*
- *Both images will need to be perceived as real in order to be integrated fully.*

* Credit: conversations with Steve Gallop

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How do they function like that?

Adaptations:
Learning to see by Logic

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Learning Objectives

LO's

Participants will be able to:

1. Recognise that a patient may consider the image from one eye to be "unreal" as a survival mechanism… but that this will interfere with the patient's ability to make integrated use of the visual information presented through that eye-channel.
2. Recognise anomalous projection as a sensory adaptation which preserves some binocular vision benefits.
3. Construct the testing environment (like a laboratory experiment), so that the doctor/therapist removes the logical "clues" that the patient typically uses to interpret space.

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Strabismics find an alternate path to interpret space

- In simple terms, AP is a form of binocularity.
- AP provides the strabismic patient with a way in which s/he can make GOOD use of visual information from **both** eyes.
- Given a large enough amount of visual input, AP can work really well!
- Where the model fails for them is when/where we REDUCE the amount of information they have.
  - In the testing room, we may take away their ability to use logic to make "accurate" interpretations of what they are seeing.

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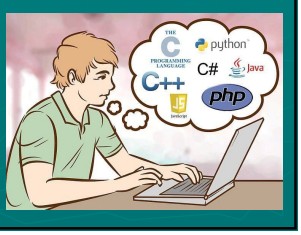
Strabismics find an alternate path to interpret space

- With strabismics, when we change the visual input, they may change their response.
- They can run "parallel software programs" which enable them to process visual data in different ways, depending on which "software" is the most effective for a given scenario.



Strabismics find an alternate path to interpret space

- In most cases, the strabismic patient has found some convenient way of either
  1. using the data from the turned eye or
  2. increasing the turn in order to avoid confusion/ diplopia awareness.

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Clinical Thinking

Remember what you are after, clinically:

- You have a patient/ WHOLE person in front of you.
- You have observed their strabismus, and from cover testing, you know the direction of the turn, which eye they may favor
- The question on your mind: How does this person *function* like that?
- What adaptations are they making in order to process space?

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Clinical Thinking

- Which channel provides them with a "ground"? Is it stable/variable?
- Can they see with both eyes at the same time (SP)?
- Can they relate the information from one channel to the information from the other channel?
- Can they combine information from the two channels into a single, unified perception?
- Can they make a motor fusion response? Is there a range over which they can keep single, clear, binocular vision?
- Can they do so with NP, or only with AP?
- Do they avoid fusion?
- Can they gain control over their perceptions? …mind over matter!?

126

Supplement: Lens Management 1

- Lenses are one of our best tools for altering the patient's visual input.

When prescribing:

- Consider what the lens does, optically:
  - Where are the images created?
  - Do they focus in the same image plane? or very close?
  - Will the OD and OS images be difficult to fuse on the Z-axis?

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Supplement: Lens Management 2

- Consider the refractive clarity:
  - Is a clear image supportive of binocular fusion?
  - Is the cyl necessary for binocular function? Does it add to the visual acuity? Quality?
  - Will a fully focused image on the non-preferred eye *necessitate suppression*, given the current eye-posture?
  - Will a fully focused image on the non-preferred eye *necessitate a change in suppression*, given the current eye-posture? (i.e., starting to suppress, modifying a suppression pattern, etc.)
  - Will a *defocused* image on the non-preferred eye *facilitate* binocular function?
  - *A monovision Rx may be an ideal interim step to binocular fusion!*
- *Revisit these questions periodically with your progress checks!*

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Break

129

What *is* Anomalous Projection?

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AP

- AP is a sensory adaptation which a strabismic patient may make in order to try to preserve some sensory binocular benefits.
  - AP is NOT an all-or-none phenomenon! (e.g. X(T))
  - ONLY under binocular conditions
  - Light falling on *part* of the retina may project to an anomalous location.
  - May function with AP *part of the time.*

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AP

- Response may change based on **context:**
  - Room illumination, peripheral contribution
- May correspond exactly with the degree of the turn:
  - Term "Harmonious ARC" used traditionally
- May show AP only when close to neutralized (prisms).
- May cover the *entire* binocular-area of the retina.
  - **Remember that each eye can see over some region which does not overlap the other eye!

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AP

- AP may help a patient **preserve gross binocular function**, e.g., with a *small angle turn.*
- AP can create great confusion on objects close to the midline.
  - This is often managed with **central suppressions** in addition to AP.
  - Also common to see an Abnormal Head Posture (AHP)/ head turn.

133

Indications of AP

1. Cover Testing
   - Unilateral Cover Test vs Alternating Cover Test
   - Flick responses
2. Bagolini lenses (with Cover Test to confirm turn despite sensory fusion)
3. Posture Campimetry, central vs periph
4. Observations of projection (e.g. MIT)

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Indications of AP

- Cover Test
  - Unilateral CT
    - Simultaneous Prism CT
    - Flick responses
  - Alternating CT
  - Differences?
- *Demonstration*

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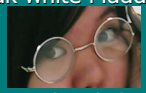
Indications of AP

- **Bagolini lenses:** basically weak white Maddox rods at 45 and 135 degrees.



- Very low amount of dissociation– makes light appear in a streak, but you can still see through the lenses
- If the patient observes an X through transilluminator but still tropes on cover test: AP.
- This is an easy test to check if patient "acts like s/he is binocular."
- A patient may show AP on Bagolinis but NP on other tests.

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Indications of AP

- Posture Campimetry … *details in handout*
  - Preferred eye – background- green filter
  - Non-Preferred eye – red light – red filter
    - Make the light "pin-point-small" with heavy tape
  - Campimetry = *mapping*
    - Map the location of the fovea of the non-preferred eye using peripheral retina (which is not likely to suppress)
    - **How does this compare to the location of the fovea when tested centrally?**
    - If X and dot are seen in the same location, cover test with motion confirms AP.
  - Peripheral Quadrant localization testing

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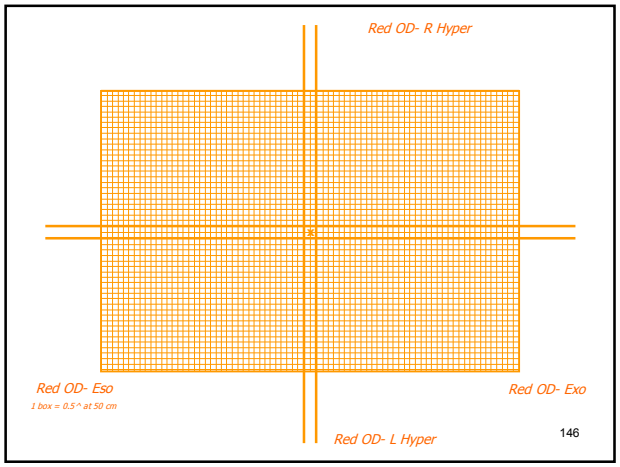

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Indications of AP

- Observations on MIT
  - Know what to expect (what eso and exo responses look like)
  - When an uncorrected ET sees exo (crossed) dpl: AP
  - When an uncorrected XT sees eso (uncrossed) dpl: AP
  - Split field: AP
    - (neurological basis = hypercolumns in visual cortex)

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Working with the patient on the MIT/ Swirl

Part 1

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Learning Objectives

LO's

Participants will be able to:

1. Recognise that Suppression is Protection, it is the brain's way of managing information which it is not prepared to see or use.
2. Know that anti-suppressive activities run the risk of disrupting the patient's safety mechanism, and should be approached with great care.
3. Employ the MIT (or Slotnick Swirl) as a target which naturally facilitates fusion (as it is large and round) while stimulating visual awareness with constant motion.

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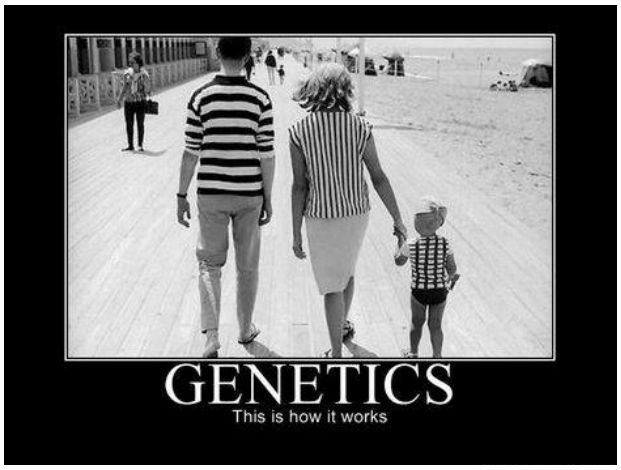

Working with the patient on the MIT

a) Rationale for using the MIT/ Swirl
b) How to manipulate images
c) How to assess and interpret the patient's observations
   - Examples
d) Image overlap or close proximity: patience and observation
e) Demonstrating for the patient his/her role in manipulating the visual experience:
   - Shoulder thrusts / Eyebrow stimulation / Body muscle clenching
f) FLOW CHART: What next?

160

Working with the patient on the MIT

- In stubborn, highly symptomatic cases (c/o dpl, motion sickness), the patient needs to first learn how to exert some control over the eyes and visual processing.
- They need to receive some biofeedback so that they know what they are actively doing, and
- They need to learn that they can gain control over the **sensory perception** as well as motor responses.
- We can help guide this in the office environment, where we reduce the amount of information available.

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Working with the patient on the MIT

- Goal 1: SIMULTANEOUS PERCEPTION
- Goal 2: FLAT FUSION
- Goal 3: VERGENCE RANGES

162

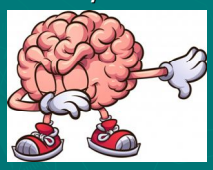
Rationale for Utilizing the MIT

- Primary Challenge: Patient is adapted for constant suppression *in order to avoid diplopia*
- Initial Goal: First degree fusion (*Simultaneous Perception*)
  - Side note: This is not necessarily where one would begin therapy for a patient with intermittent strabismus (e.g., Divergence Excess).
  - With intermittent strabismus, suppression is not an obstacle to binocularity. These patients can start from binocular alignment and build ranges.
  - However, with constant strabismus, the first step to alignment requires *simultaneous perception*.
  - *This is the ONLY instance where I recommend an activity for "ANTI-SUPPRESSIVE" purposes. Please use with care!*

163

Suppression = Protection

- Suppression is the brain's way of managing that which it is not ready to see/ make use of.



164

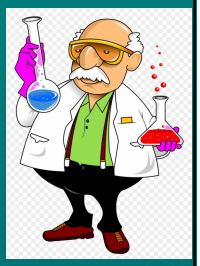
Suppression = Protection

- Suppression is an internally mediated protection mechanism.
- When doing an ANTI-SUPPRESSIVE ACTIVITY, we are running the risk of **disrupting the patient's safety mechanism**.
- As such, please exercise caution.

165

Suppression = Protection

- One way we can maintain caution is to provide a wholly unnatural viewing environment.
- Consider the VT room an "experimental laboratory" where the patient with strabismus can explore this unnatural viewing environment without associating it with their real-world environment.

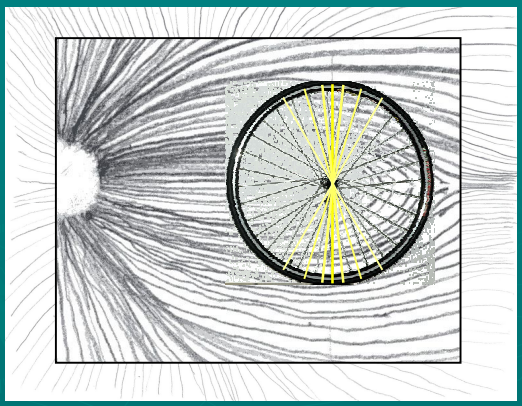


Rationale for Utilizing the MIT

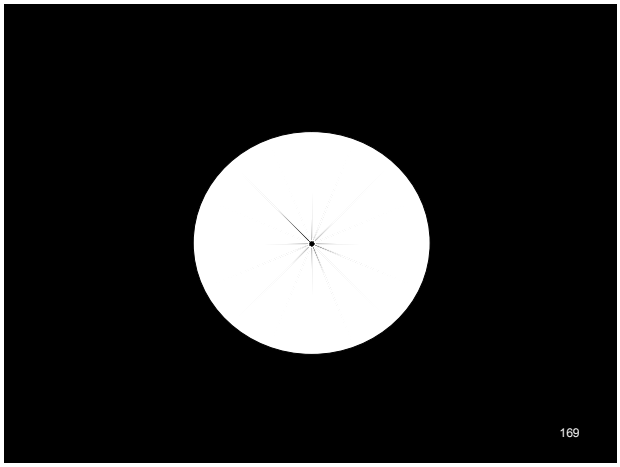
Instrument Advantages:

- Difficult to maintain monocular suppression
  - The MIT Trainer presents *constant motion* over the macula, making it very difficult to maintain monocular suppression of the image
- Image Distinction
  - The patient can readily identify which image originated from which eye (Red/Blue)
- Readily fusable image: Gross fixation target
  - Large circular target
  - Rounded edges gently encourage fusion while fixation is guided towards the center of each circle.
    - *Haidinger Brush is **not** introduced*

167



168



169

For Basic Binocular Training: This is the plan!

- Step 1: SP (if needed)
- Step 2: Flat fusion (many can start *here*)
- Step 3: Control over lustre (very empowering for your patients!)
- Step 4: Maintenance of OU perception **over a range**
  - **Ramp:** Dynamic movement forward/back along z-axis,
  - **Steps:** Use prism bar, or lollipop for small jump-ductions/ recoveries
- Step 5: Push beyond the present **threshold** (whether converging or diverging)
  - When instability begins, stop moving and try to recover lustre perception.
  - *Return to your starting position* rather than continue beyond first threshold.
  - On next attempt, use momentum to maintain range beyond previous threshold.
  - *Recommend working on **BO** (positive, voluntary effort) before **BI** ranges, regardless of the binocular posture, or presence/absence of strabismus.*

170

For Basic Binocular Training: This is the plan!

- Step 1: SP (if needed)
- Step 2: Flat fusion (many can start *here*)
- **Only difference for compensated strabs:** Gradually reduce the prism compensation provided (over weeks/months) as they work through these 5 steps.

converging or diverging)

- When instability begins, stop moving and try to recover lustre perception.
- *Return to your starting position* rather than continue beyond first threshold.
- On next attempt, use momentum to maintain range beyond previous threshold.
- *Recommend working on **BO** (positive, voluntary effort) before **BI** ranges, regardless of the binocular posture, or presence/absence of strabismus.*

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Working with the strabismic patient

- Dissociate the patient: R/B Filters
- Ask questions about what they are seeing
- Don't lead the patient: "Is the red one over here?"
- Give options, including:
  - Is the image on the right side, left side?
  - Higher, lower?
  - Does it switch back and forth across the sides?
  - Is it stable? Darting around?

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Step 1/2

Implementing the Strategy: How to establish flat fusion with MIT

First, help the patient to experience simultaneous perception:

- Use R/B glasses while viewing MIT
- Place Red filter over *turned* eye:
  - Increases relative strength of signal to strabismic eye
  - Provides sympathetic stimulation to the under-used pathway, according to the principles of syntonic phototherapy

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Step 1/2

Implementing the Strategy

- Use a prism bar(s) to try to gain superposition of the two images.
- Begin with OVERCORRECTING prism for the presenting turn.
  - Excess BO for ET; Excess BI for XT.
- Establish SP with NP.
- Gradually reduce the prism power.
- Record changes in perception with each step.
  - Images separated? Abutting? Overlapping? % overlap?

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Step 1/2

Implementing the Strategy

- If images *jump over* the superposition point, have patient view through the prism power which keeps the images closest (either eso or exo diplopia).
- With this level of prism correction, allow the patient to *simply observe* whether the separation continues to decrease or if it increases instead.
  Do not encourage active effort.
- Patient also *observes* whether there is *any* overlap between the two images, and whether lustre response can be appreciated in overlapping areas.

175

Step 2

Implementing the Strategy

- Once the images are superimposed (even partially), **allow viewing time**.
- Initial percept may be rapid alternation
- Lustre may take time.
  - It may help if you describe it so that the patient can identify it.

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Step 3

Refining the **Quality** of the Percept

- Guide the patient to alter the relative strength of the red or blue contribution to lustre:
  - Shoulder thrusts
  - Body Tensing
  - Touch the patient above the brow of the strabismic eye to increase the input through that channel
  - LEAVE **TIME** TO OBSERVE/PROCESS

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Step 4

Build binocular fusion ranges

- Step 4: Maintain OU lustre perception over a range
  - **Ramp:** Dynamic movement forward/back along z-axis,
  - **Steps:** Small jump-ductions/ recoveries
    - Prism bar
    - Lollipop prisms
  - *Work on **BO** (positive, voluntary effort) before **BI** ranges.*
  - *Regardless of the binocular posture,*
  - *Regardless of presence/absence of strabismus.*

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Step 5

Expand binocular fusion ranges

- Step 5: Push beyond the present fusion **threshold** (whether converging or diverging)
  - When instability begins, stop moving and try to **recover lustre perception**.
  - *Return to your starting position* rather than push beyond first threshold.
  - On ***next*** attempt, use **momentum** to maintain range beyond previous threshold.
- *Again, recommend working on **BO** (positive, voluntary effort) before **BI** ranges.*

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How to develop binocular image processing, Flat Fusion

- Flow chart, created as a support guide.

Decision Tree includes:

- Initial assessment with MIT/Swirl: **Diagnostic**
- Development of binocular processing over a vergence range with MIT/ Swirl: **Therapeutic**
- **Goal:** Binocular fusion with vergence ranges.

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Flow chart tracks: Overview

- A-Track: Patient demonstrates SP and attains FF with support; prepared to develop sensorimotor vergence ranges.
- C-Track: Patient has SP, but *AP interferes with sensorimotor fusion*.
- B-Track: Patient has SP but not establishing sensory fusion of full MIT/Swirl target.
  - More active decision-making and interpretation involved.

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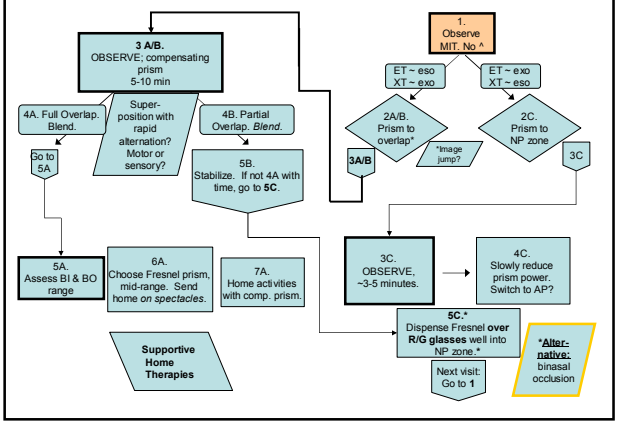
FLOW CHART, overview



Using the Flow Chart

- Observe.
- Decide.
- Observe… **leave time.**
- Decide… ready for next step?
  - If yes, move towards building binocular ranges
  - If no, move towards supporting simultaneous processing.

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Guiding Principles

1. OUR goal in therapy:
   Functional binocularity, with or without compensatory prism.
2. Train binocular flexibility,
   - both convergence and divergence,
   - and train with respect to accommodation.
3. Reduce dependence on motor supports (prism)

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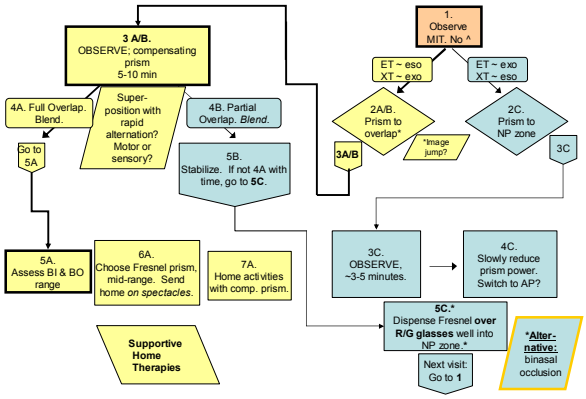
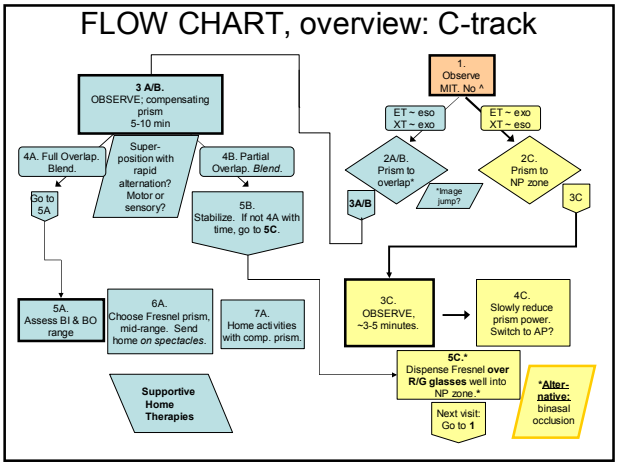
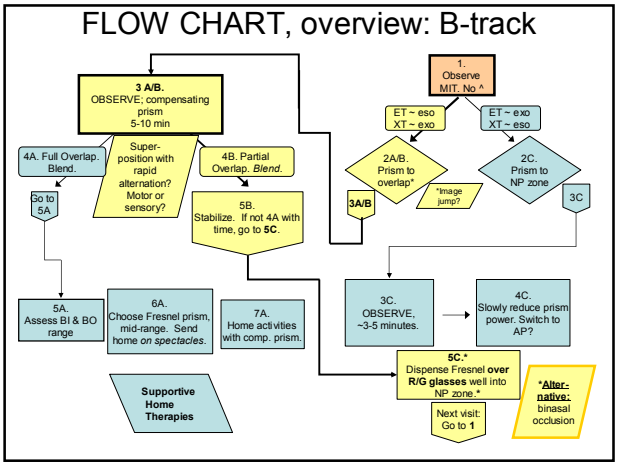
FLOW CHART, overview: A-track



FLOW CHART, overview: C-track



FLOW CHART, overview: B-track



A-track of Flow Chart: Patient achieves binocular alignment

1. "Relative" BO/BI ranges
2. Select Fresnel prism; decide when to decrease power

Next steps:

1. Reduce the compensation (decrease prism)
2. Stabilize and grind prism into Rx

OR

1. Refer for surgery, as patient is now a good candidate for a successful outcome.
2. Continue Post-surgery VT to stabilize and assure success. BEGIN IMMEDIATELY (WITHIN 3-4 DAYS).
   - VT is necessary post-surgery because the neuro-muscular relationships have changed.

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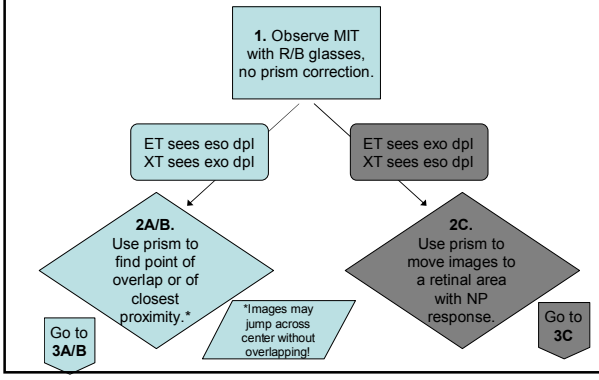
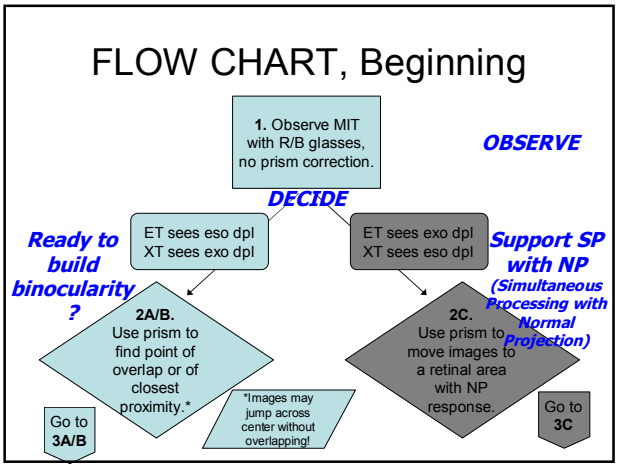
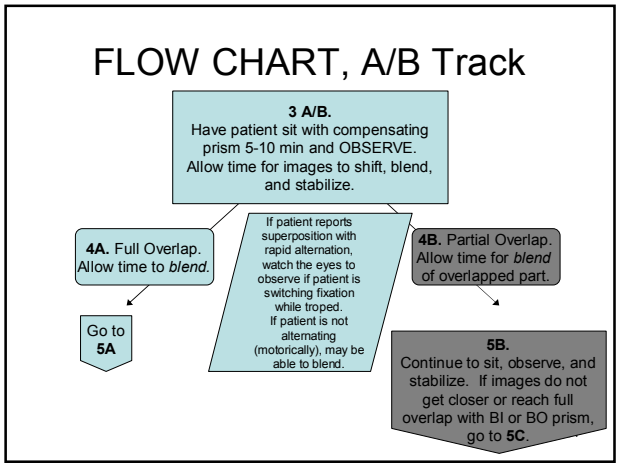
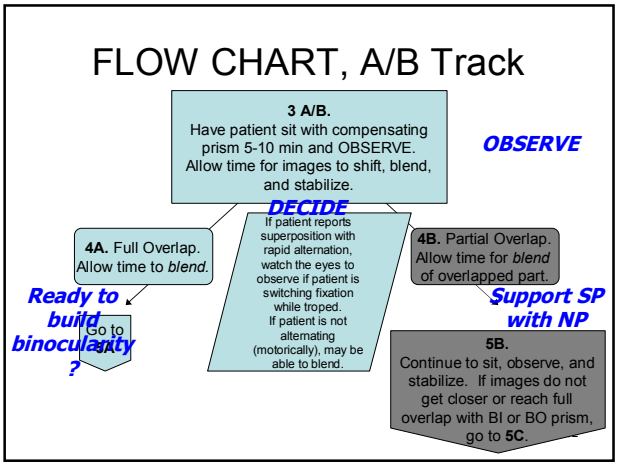
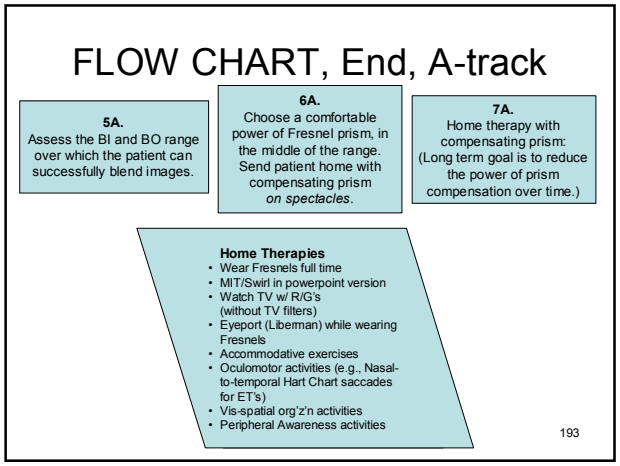
FLOW CHART, Beginning

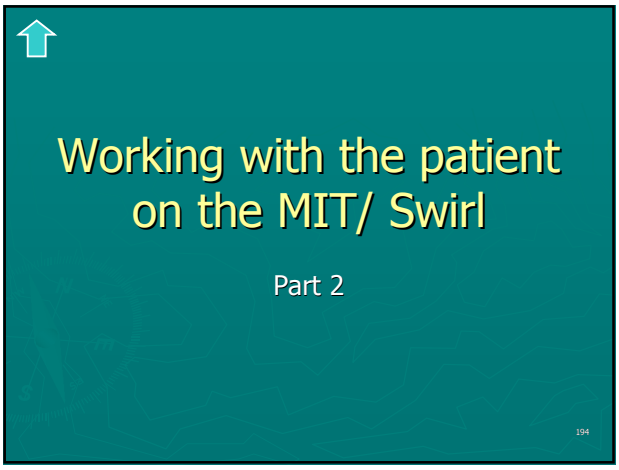


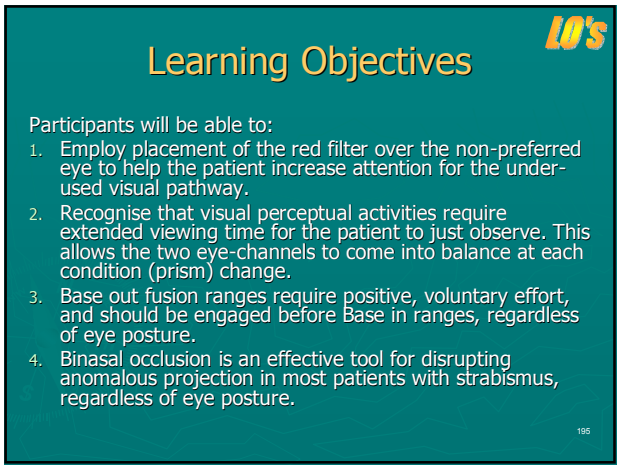

FLOW CHART, Beginning
1. Observe MIT with R/B glasses, no prism correction.
OBSERVE
DECIDE
ET sees eso dpl XT sees exo dpl
ET sees exo dpl XT sees eso dpl
Ready to build binocularity ?
Support SP with NP
(Simultaneous Processing with Normal Projection)
2A/B. Use prism to find point of overlap or of closest proximity.*
2C. Use prism to move images to a retinal area with NP response.
*Images may jump across center without overlapping!
Go to 3A/B
Go to 3C


FLOW CHART, A/B Track
3 A/B. Have patient sit with compensating prism 5-10 min and OBSERVE. Allow time for images to shift, blend, and stabilize.
4A. Full Overlap. Allow time to blend.
If patient reports superposition with rapid alternation, watch the eyes to observe if patient is switching fixation while troped. If patient is not alternating (motorically), may be able to blend.
4B. Partial Overlap. Allow time for blend of overlapped part.
Go to 5A
5B. Continue to sit, observe, and stabilize. If images do not get closer or reach full overlap with BI or BO prism, go to 5C.


FLOW CHART, A/B Track
3 A/B. Have patient sit with compensating prism 5-10 min and OBSERVE. Allow time for images to shift, blend, and stabilize.
OBSERVE
DECIDE
4A. Full Overlap. Allow time to blend.
If patient reports superposition with rapid alternation, watch the eyes to observe if patient is switching fixation while troped. If patient is not alternating (motorically), may be able to blend.
4B. Partial Overlap. Allow time for blend of overlapped part.
Ready to build binocularity ?
Support SP with NP
5B. Continue to sit, observe, and stabilize. If images do not get closer or reach full overlap with BI or BO prism, go to 5C.


FLOW CHART, End, A-track
5A. Assess the BI and BO range over which the patient can successfully blend images.
6A. Choose a comfortable power of Fresnel prism, in the middle of the range. Send patient home with compensating prism on spectacles.
7A. Home therapy with compensating prism: (Long term goal is to reduce the power of prism compensation over time.)
Home Therapies
• Wear Fresnels full time
• MIT/Swirl in powerpoint version
• Watch TV w/ R/G's (without TV filters)
• Eyeport (Liberman) while wearing Fresnels
• Accommodative exercises
• Oculomotor activities (e.g., Nasal-to-temporal Hart Chart saccades for ET's)
• Vis-spatial org'z'n activities
• Peripheral Awareness activities
193


Working with the patient on the MIT/ Swirl
Part 2
194


LO's
Learning Objectives
Participants will be able to:
1. Employ placement of the red filter over the non-preferred eye to help the patient increase attention for the under-used visual pathway.
2. Recognise that visual perceptual activities require extended viewing time for the patient to just observe. This allows the two eye-channels to come into balance at each condition (prism) change.
3. Base out fusion ranges require positive, voluntary effort, and should be engaged before Base in ranges, regardless of eye posture.
4. Binasal occlusion is an effective tool for disrupting anomalous projection in most patients with strabismus, regardless of eye posture.
195

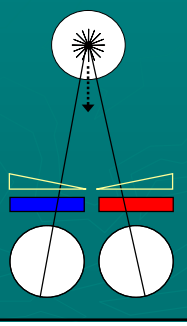
When does AP interfere with the potential for continuous, functional binocular performance?

Patient viewing MIT with R/B glasses

Introduce BO prism

Move image towards patient

Before the patient makes a motor fusion response, they are given the **STIMULUS TO CONVERGE**



Perception

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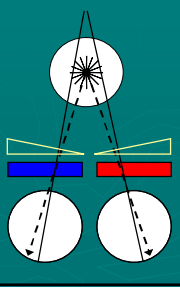
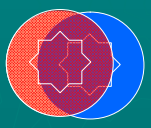
When does AP interfere with the potential for continuous, functional binocular performance?

Patient viewing MIT with R/B glasses

Before the patient makes a motor fusion response, they are given the **STIMULUS TO CONVERGE**



Desired Perception



When BO^ is added, Visual axes directed *behind* new target position.

Temporal retina; nasal projection.

Should show exo diplopia (crossed disparity)

When does AP interfere with the potential for continuous, functional binocular performance?

- What if there is a different perception???

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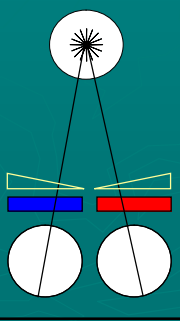
When does AP interfere with the potential for continuous, functional binocular performance?

Patient viewing MIT with R/B glasses

If the patient perceives a **sensory stimulus to DIVERGE** *(eso/ uncrossed dpl)* with a **motor requirement to CONVERGE**, there is a sensory/motor CONFLICT.



Perception with AP

The patient cannot maintain smooth and continuous fusion over a volume of space with a conflict between sensory and motor input.

199

AP interfering with motor fusion

- When AP affects a large area of the retina (may occur with moderate turns, 20-35^), it may interfere with the potential for MOTOR FUSION.
  - AP creates an anomalous form of sensory fusion:
  - The cues to diverge (stimulate nasal retina) or converge (stimulate temporal retina) are *inconsistent* with the actual target location in space.

200

IF Patient cannot yet achieve binocular function: C-track

- Disrupt the tendency for AP: **Return the patient to the "factory default setting."**

1. Utilize a part of the retina which is not anomalously projecting.
   1. Where to begin
   2. How to confirm this is an NP region.
2. Options for disrupting AP
   1. Binasal occlusion
   2. Overcorrecting prism
   3. Opposite prism
   4. Vertical diplopia

201

Supplement: Binasal Occlusion

- For which cases?
  - Hyper: reduces vertical turn
  - Eso: encourages divergence
  - Exo: encourages convergence!
  - ABI: reduces the amount of binocular processing without losing visual field
- Where?
  - Always angle nasally downward/inward for convergence
  - For strabismus, slightly nasal to iris limbus
    - May reduce to cover plica, or vary symmetry between eyes
  - For information processing, caruncle/globe border may be sufficient.

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CHAPTER 25

Samantha Slotnick, OD, FAAO, FCOVD
Curt Baxstrom, OD, FAAO, FCOVD, FNORA
Jason Clopton, OD, FCOVD

Optometric Management of Functional Vision Disorders for the Patient with Special Needs

FIGURE 25-8. Binasal occlusion for the treatment of vertical deviations. **Top**: Left hyperexotropia. The dominant eye gets much stronger image; the image from the nondominant eye is ignored, and strabismus remains. **Middle:** Binasal occlusion is applied; the brain no longer has to choose between processing spatial information from one of two competing images. **Bottom:** Brain favors *visual closure* and enables the eyes to work collaboratively to make one composite image, removing hyper and significant exo component. Patient functions with simultaneous perception (first-degree fusion). Facilitates obtaining second- and third-degree fusion (flat fusion and stereopsis, respectively).

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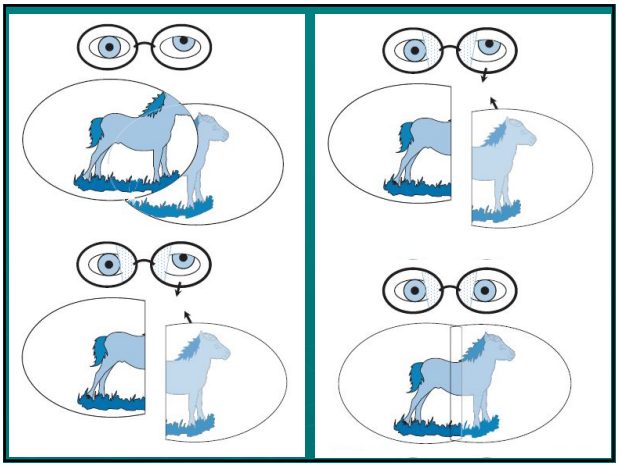

Visual Input Activities: Safety

- Strabismic patients often ignore parts of their visual world in order to avoid confusion and to avoid diplopia.
- Sometimes, a patient will start to experience double vision in their typical ocular posture after non-alignment is brought to their awareness.
  - *X(T) patients (children) sometimes report diplopia after crossing their eyes (like their friends in school).*
  - *Once they learn to see double, they have trouble un-seeing double in their natural posture.*

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SAFETY FIRST

- It is the RESPONSIBILITY of the Optometrist to provide UNNATURAL settings in which to explore simultaneous perception.

- It IS RISKY to create diplopia awareness:
- You DO NOT WANT YOUR PATIENT to wind up with INTRACTABLE DIPLOPIA.

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SAFETY FIRST

- You can PROTECT YOUR PATIENT by CONDUCTING ALL SIMULTANEOUS PERCEPTION ACTIVITIES WITH RED/GREEN (or RED/BLUE) **dissociating filters**.

- AVOID VERTICAL PRISM DISSOCIATION ACTIVITIES until your patient can demonstrate CONTINUOUS FLAT FUSION in their NATURAL ENVIRONMENT...
  OR: ADD RED/GREEN PROTECTION.

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SAFETY FIRST:

PRESCRIBING is part of the Treatment!

- Please keep in mind that the decision to send a patient home with PRISMS and/or COLORED FILTERS is considered a **PRESCRIPTION**.
- The **MANAGING DOCTOR** is responsible for such prescriptions.
- Vision Therapists should not unilaterally decide to send a patient home with over-correcting prism, compensating prism, or even just red/green glasses.
- ***Any such decisions need to be made in partnership with the supervising O.D.***

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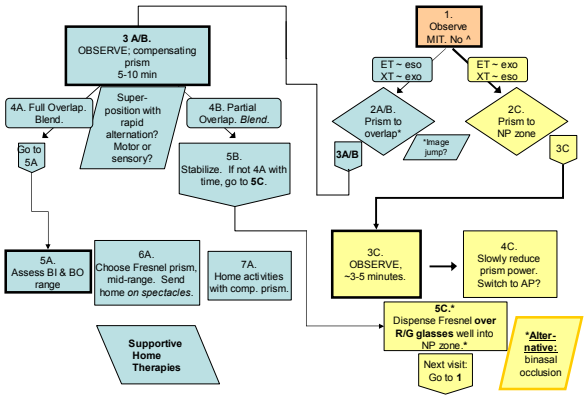
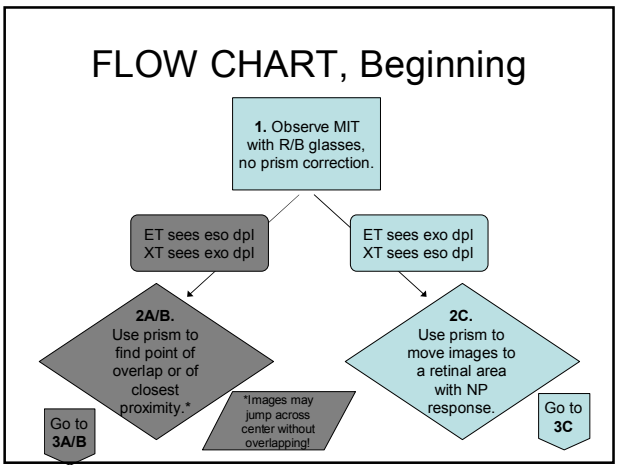
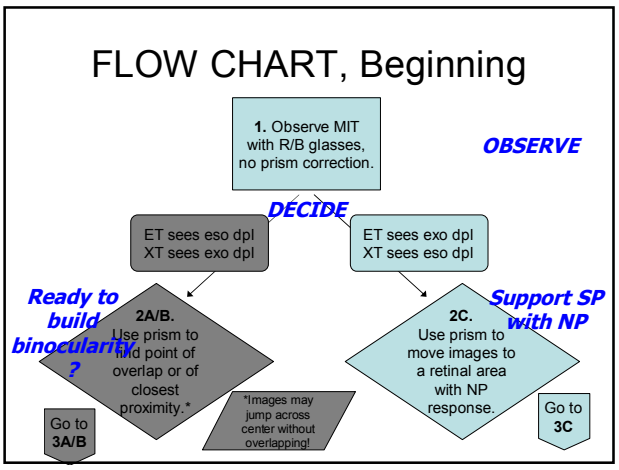
FLOW CHART, overview: C-track



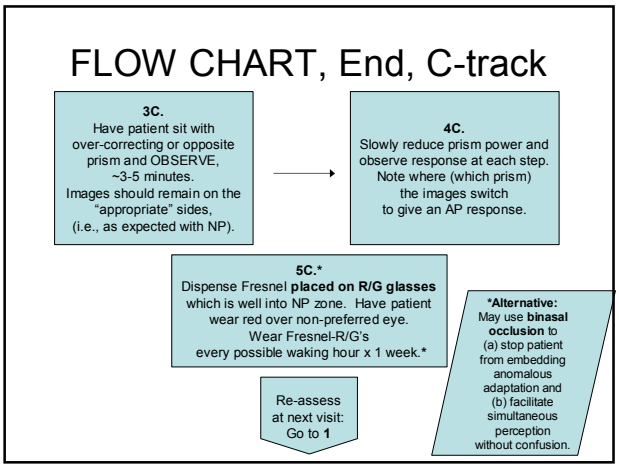
FLOW CHART, Beginning



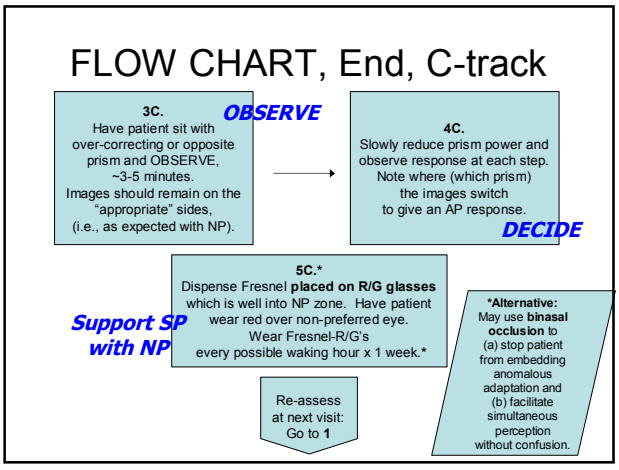
FLOW CHART, Beginning



FLOW CHART, End, C-track



FLOW CHART, End, C-track



Patient demonstrates modified binocular function: B-track

- Partial image overlap on MIT; observes image blend.
- Positive prognosis, but further effort is required in achieving binocularity without sensory/motor conflict. Refer to C-track.
  - This step may respond very well to binasals!

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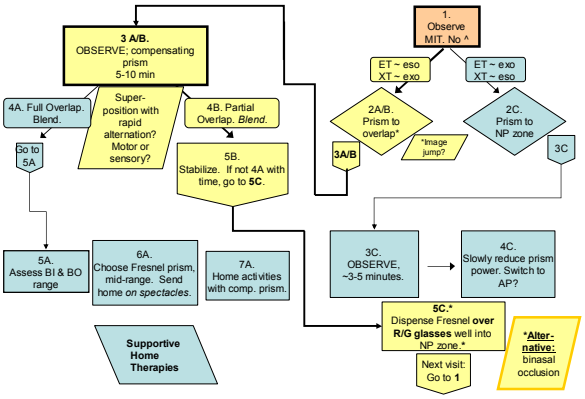
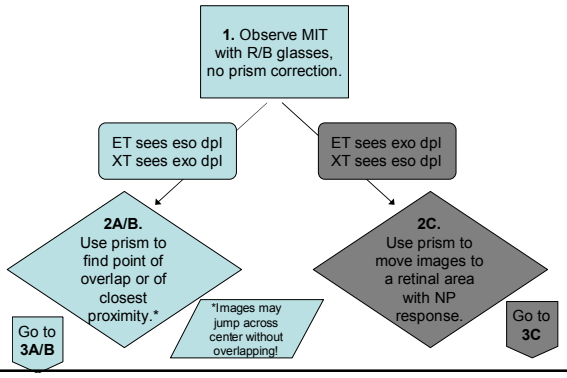
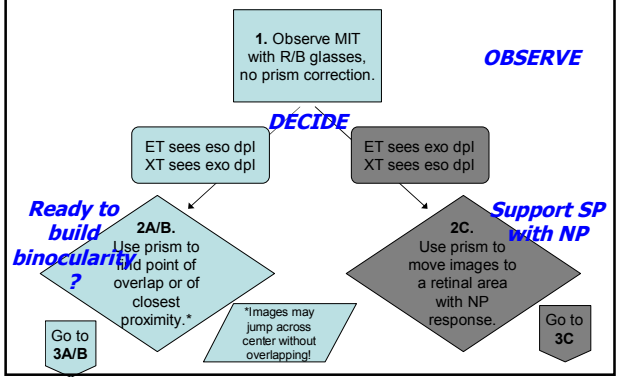
FLOW CHART, overview: B-track



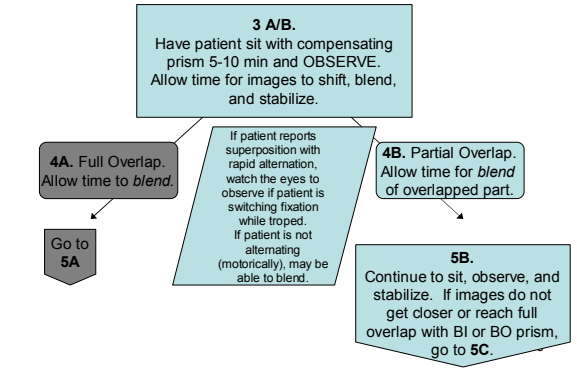
FLOW CHART, Beginning



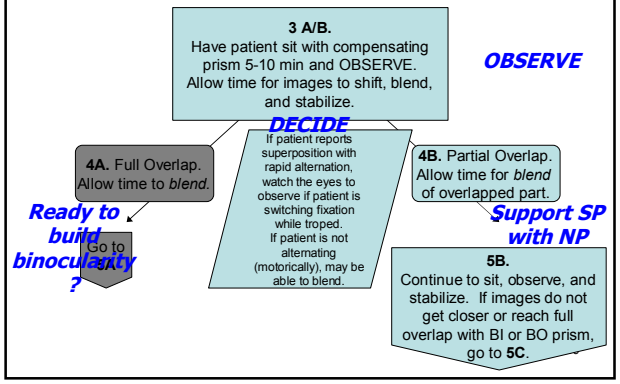
FLOW CHART, Beginning

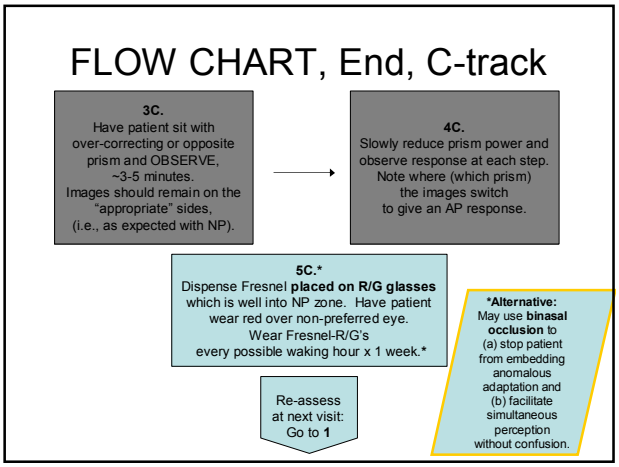


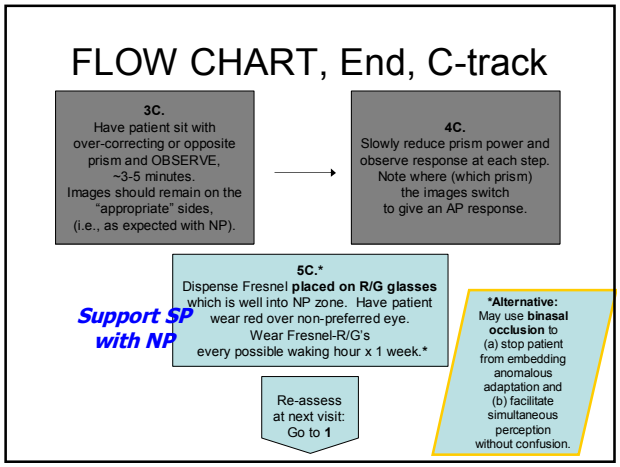
FLOW CHART, A/B Track



FLOW CHART, A/B Track







Troubleshooting

1. My patient only sees one image
   - Ascertain which eye sees image;
   - Cover that eye to prompt viewing of other eye's image;
   - Use a prism to move other image closer to central field.
   - May need to try overcorrecting prism to push image to an under-stimulated area of the retina.
   - May need to create *image alternation*: Polarized filters to be used WITH red/green glasses.
     - Remember, it will NOT be possible to get blended images this way! This is just a stepping stone to 1° fusion (SP)!

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Troubleshooting

2. When I bring in the prism bar, the patient reports 2 blue circles and one red circle (or vice versa).
   - Check prism bar placement– likely viewing the image twice, both thru prism and external to prism. Eye is often not centered in the orbit!
   - May be seeing an extra reflection off one of the lens or filter surfaces– in which case the image is usually a different size, or distorted. Have the patient pay attention to the "most real" image.

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Troubleshooting

3. My patient has simultaneous perception, but she reports "exo" (crossed) diplopia despite having esotropia (or vice versa).
   - AP is interfering with the potential for binocularity: Need to disrupt this adaptation first.
   - If binasals x 1 week do not work…. Use overcorrecting prism (high BO for ET's, high BI for XT's) sufficient to see the "expected" orientation of diplopia;
   - Induce constant diplopia for patient for a full week. ALWAYS, ALWAYS use red/green (blue) glasses with diplopia therapy at home. This also helps the patient distinguish which image comes from which eye. Make sure patient can maintain the diplopia in real space (not just on MIT). Have patient walk around office with new prism in place.
   - Continually alter nature of the disruption if paradoxical percept persists (then try vertical diplopia… or high BI for ET's, high BO for XT's).
   - Use the red on the turned eye first, but you may reverse red and green to continue to confuse the patient's visual system.

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Role of the Therapist

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Clinical Sidebar: Working with the Strabismic Patient on the MIT

- Your patients will want to please you.
  - Be especially careful with children (and with patients who have emotional problems) that you are getting honest responses.
  - Be careful not to "lead the patient" with your questions: a smart kid will figure out what he is "supposed" to say.
- It is tempting for the strabismic patient to solve the "fusion problem" by just converging and diverging for target overlap.
  - Encourage the observation of changes in size, localization. This supports sensorimotor localization.
  - The lasting solution is to *aim for the target*, which requires them to localize along the z-axis, not merely to converge or diverge.

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Clinical Sidebar: Working with the Strabismic Patient on the MIT

- Your strabismic patient may experience new and unusual visual experiences, for which they may have difficulty finding words to describe it. They may not know whether what they see is "okay."
  - Offer options which describe the MIT, so that they know their experience isn't "wrong."
  - This helps to build their confidence in what they are reporting *and to feel safe with you.*

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Relating to your Patient

- When you can identify "where the patient is," you can chaperone the patient from State A to State B:
  - From State A – strabismic processing – a compartmentalized perception of space(s)…
  - To State B – non-strabismic processing – an expanded, integrated, continuous perception of **SPACE,** which is maximally supported with non-strabismic sensorimotor alignment.

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Summary: Clinical Thinking

Identifying your patient's "State A", their sensorimotor status:

- Your goal: see the world through the eyes of your patient.
- You have observed their strabismus, and from cover testing, you know the direction of the turn, which eye they may favor
- The question on your mind: How does this person *function* like that?
- What adaptations are they making in order to process space?

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Summary: Clinical Thinking

- Which channel provides them with a "ground"? Is it stable/variable?
- Can they see with both eyes at the same time (SP)?
- Can they relate the information from one channel to the information from the other channel?
- Can they combine information from the two channels into a single, unified perception?
- Can they make a motor fusion response? Is there a range over which they can keep single, clear, binocular vision?
- Can they do so with NP, or only with AP?
- Do they avoid fusion?
- Can they gain control over their perceptions? …mind over matter!?

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Next up…

- Top-Down Processing and VT program design:
  - Building a 4-D Brain
  - Concepts for vision therapy activities
- As time allows:
  - Supplementary activities to help your patient enhance their 4-dimensional visual processing skills, which are best supported by sensorimotor alignment.

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Feedback welcome!

Thank you

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END Part 1

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