DIAGNOSIS AND MANAGEMENT OF AMBLYOPIA

Jenelle Mallios, OD, FAAO
Associate Professor of Optometry
Chicago College of Optometry
Outline

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- The Exam
Learning Objectives

- Apply knowledge from the amblyopia studies to an amblyopia therapy regimen
- Understand concepts from amblyopia studies and integrate them with prescribing
Amblyopia

- Unilateral or bilateral decrease in vision caused by visual deprivation with no ocular pathology

- Diagnosed during childhood

- Must have amblyogenic factor
  - Form Deprivation
  - Strabismus
  - Anisometropia
  - High Isometropia
Amblyogenic Factors

- Strabismus
  - Misalignment of the eyes results in suppression of input from one eye in order to avoid visual confusion
    - Criteria:
      - Constant (or mostly constant)
      - Unilateral (or mostly unilateral)
      - Distance and Near
      - Direction (eso vs exo)
      - Onset before the critical period

- Form Deprivation
  - Examples:
    - Congenital or Traumatic Cataract
    - Early complete ptosis
    - Corneal Opacity
    - Vitreous Hemorrhage
Poll Question #1

Which of the following examples will potentially have amblyopia secondary to strabismus?

- A. 12pd Intermittent Left Exotropia at Distance and Near
- B. 20pd Constant Alternating Esotropia at Distance and Near
- C. 20pd Intermittent Alternating Exotropia at Dist and 10pd Exophoria at Near
- D. 16pd Constant Right Esotropia at Distance and Near
## Amblyogenic Factors

<table>
<thead>
<tr>
<th>Refractive:</th>
<th>Isometropia</th>
<th>Anisometropia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Astigmatism</td>
<td>&gt;2.50D</td>
<td>&gt;1.50D</td>
</tr>
<tr>
<td>Hyperopia</td>
<td>&gt;5.00D</td>
<td>&gt;1.00D</td>
</tr>
<tr>
<td>Myopia</td>
<td>&gt;8.00D</td>
<td>&gt;3.00D</td>
</tr>
</tbody>
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Poll Question #2

- Given the following refractive error, what type of amblyopia does this patient potentially have? OD: +5.25 – 2.75 x 180
  OS: +4.00 – 2.50 x 180

A. Amblyopia OD secondary to anisometropic hyperopia
B. Amblyopia OU secondary to high astigmatism OU
C. Amblyopia OD>OS secondary to anisometropic hyperopia and high astigmatism OU
D. Amblyopia OD>OS secondary to anisometropic hyperopia and high hyperopia and high astigmatism OU
Amblyopia; a spatial vision problem

- **Central (parvo)**
  - High spatial frequency
  - High contrast
  - Low temporal frequency
  - Photopic light conditions

- **Peripheral (magno)**
  - Low spatial frequency
  - Low and middle contrast
  - High temporal frequency
  - Mesopic light conditions
Amblyopia Findings

- Amblyopia is more than simply reduced visual acuity:
  - Decreased central BCVA in one or both eyes
  - Decreased stereopsis
  - Affected by crowding phenomenon
  - Strabismus (may be secondary to poor vision/microtropia)
Amblyopia

Findings

- Additional Findings:
  - Poor eye tracking
  - Reduced contrast sensitivity
  - Abnormal spatial distortions
  - Normal peripheral vision
  - No clinically apparent ocular or visual pathway anomalies
Diagnosis of Amblyopia: Key points

- Amblyopia is a diagnosis of inclusion and exclusion
- Diagnosis must make sense in severity
- Response to treatment is part of the diagnosis
Inclusion vs Exclusion

**Exclusion:**
- rule out ocular pathology as a cause of decreased vision by at least performing thorough anterior and posterior ocular health assessment with DFE

**Inclusion:**
- must be able to document a specific etiology for the amblyopia such as
  - Amblyogenic refractive error
  - Amblyogenic strabismus
  - Amblyogenic form deprivation
Severity

- Expected VA loss secondary to amblyopia

- Anisometropic and Strabismic
  - Typical acuity loss: 20/30-20/100
  - Refractive amblyopia should make sense in severity

- Form deprivation can be worse
- Long standing strabismic amblyopia can be worse
- NLP or LP do not result from amblyopia
Response to Treatment

Should get better as treatment begins

- Understand prognosis

If no improvement...

- Incorrect diagnosis
- Wrong prescription
- Compliance
Prescribing

- **Proper Refractive correction:**
  - Eliminating optical blur and providing an optimal environment for amblyopia therapy is essential

- **Anisometropia**
  - The anisometropic difference between the two eyes MUST always be maintained in the glasses

- **Astigmatism**
  - The FULL amount needs to be corrected

- **Hyperopia**
  - If/when reduced for children without strabismus, done symmetrically

- **Hyperopia with Esotropia**
  - Full amount of hyperopia or undercorrecting by +0.50D based on cycloplegic refraction

- **Myopia**
  - The full amount is corrected

*Based on PEDIG protocol*
Case 1

Visit 1: Patient AB

- 5yo female
- CC: Failed school screening; Mom reports occasional squinting
- Birth, developmental, and educational hx – all unremarkable

Findings:

- DVAsc: OD: 20/60  OS: 20/100  Lea S-line
- PERRLA –APD
- EOMs: SAFE
- CTsc: 2 EP, 4 EP’
- Stereo: RDS: 250”  WC: 100”
- SLE: unremarkable
Case 1 continued

Cyclo Ret:
- OD: +3.00-3.25x180  20/40
- OS: +4.50-3.50x180  20/80

Final RX:
- OD: +1.50-3.25x180
- OS: +3.00-3.50x180

A/P
- Amblyopia OS>OD 2’ to high astigmatism and anisometropic hyperopia
- Educated FTW of Rx and RTC 3 months for amblyopia follow-up
Evaluating optical correction alone in anisometropic amblyopes
- 84 children ages 3-<7 yo with VAs: 20/40-20/250

- VA improved with glasses by $\geq$ 2 lines in 77%
- Amblyopia resolved* completely in 27% with glasses alone
- Average improvement was 3 lines

* Resolved defined as interocular difference of one line or less
ATS7: Optical correction for bilateral refractive amblyopia

- 113 children, 3-<10 y.o with VA 20/40-20/400
- Hyperopia: >/= 4.0D, Astigmatism: >/= 2.0D

- Glasses alone improved VA to 20/25 or better within 1 year
Optical correction for strabismic amblyopia or combined mechanism amblyopia

- 146 children, 3 - <7 yo

- 75% >/= 2 line, 54% >/= 3 lines
- Resolution of amblyopia in 32%
- Greater improvement in strabismic amblyopia alone (3.2 vs 2.3 lines)
Case 1 continued

Visit 2: Patient AB returns after 3 mos
- VA improves OD: 20/30      OS:20/60
- Stereo WC: 70"
  - Continue to wear Rx FT and rtc 3 mos for amblyopia follow up

Visit 3 and 4: At subsequent two appointments
- VA:   OD: 20/25      OS: 20/50
- Stereo WC: 60"
6h/day vs Full time patching

- 175 children 3 to <7yo with severe amblyopia (20/100-20/400)
- Either 6 vs full time patching (all hours or all but 1 hour) with 1 hour near work included during patching
- Amblyopia secondary to strabismus, anisometropia or both
- Conclusion: Measured VA after 4 months: improvement of VA was of similar magnitude (4.7 lines) in both groups
2 vs 6h/day patching

- 189 children 3-<7yo with moderate (20/40 - 20/80) amblyopia

- Either 2 vs 6 h/day patching with 1 hour near work included during patching

- Amblyopia secondary to strabismus, anisometropia or both

- Conclusion: Measured VA after 4 months: improvement of VA was of similar magnitude (2.4 lines) in both groups
Atropine vs Patching for Moderate Amblyopia

- 419 children, <7yo with moderate amblyopia
- Either 6 h/day (or more) patching (n= 215) or 1gtt 1% Atropine daily (n=204)
- 6 month outcome: improvement in VA was of similar magnitude from both therapies, although improvements from patching were more rapid
Adverse Effects:

- In patching group: 41% reported mild skin irritation at least once
- In atropine group: most common adverse effect was light sensitivity (18%)

Quality of Life questionnaire: scores were consistently worse for patching than atropine in respect to:

- Adverse effects
- Difficulty with compliance
- Social stigma
ATS 4
ophthalmology 2004; 111: 2076-85

Weekend vs Daily Atropine therapy

■ 168 children, 3-<7 yo with moderate amblyopia

■ Either daily atropine or weekend atropine for 4 months

■ 4 month outcome: Similar improvement in VA in both treatment groups (~2.3 lines)
Patching 2 hours with near vs distance activities

- 425 children 3 - <7 yo with VA 20/40-20/400
- Amblyopia 2’ to anisometropia, strabismus or mixed
- Either 2 hours/day patching with near activities or with distance activities
- At 8 week outcome: similar improvement of VA in amblyopic eye in both groups: distance activity (2.6 lines) and near activity (2.5 lines)
- Similar outcomes even at 2, 5, and 17 week visits
A patient came in for their first eye exam and has been diagnosed with anisometropic refractive amblyopia OD (VA: 20/60). You prescribed the patient glasses and the patient returns for their 3 month follow up and their vision improves to 20/40. What would your next step be?

- A. Have the patient continue wearing the glasses full time and have them return in 3 months
- B. Begin patching OS for 2 hours/day, 7 days/week
- C. Begin Atropine 1%, 1 gtt OS on the weekends
- D. Begin patching OS for 6 hours/day, 7 days/week
What Now?
Case 1 continued

Review:
- VA: OD: 20/25  OS: 20/50
- Stereo WC: 60”

- Prescribed 3 h/day of patching OD, 7d/week, while continue FTW of glasses. RTC 3 mos for amblyopia follow up

Visit 5:
- VA: OD: 20/25+  OS: 20/30
- Stereo WC: 30”

- Continue patching OD 3h/day, 7d/week, while continue FTW of glasses. RTC 3 mos for amblyopia follow up
Monitored Occlusion Treatment of Amblyopia Study (MOTAS)
BMJ 2007; 335; 707

Objectively monitoring patching regimens for treatment of amblyopia with 6 vs 12h/day of patching

- 80 children 4-7 yo with amblyopia randomized to either 6 vs 12h/day patching with occlusion dose monitor

- Mean improvement in VA was similar between both groups

- Mean dose rates were also not significantly different
  - 6h/day group averaged 4.2h/day
  - 12h/day group averaged 6.2h/day
Case 1 continued

Visit 6:

- VA: OD: 20/20- OS: 20/25+
- Stereo WC: 25”

- Prescribed 2h/day of patching OD, 5d/week, while continue FTW of glasses. RTC 3 mos for amblyopia follow up
Increasing patching for amblyopia

169 children, ages 3-8

Stable residual VA (amblyopic) after 12 weeks patching 2 hr/day

Randomized: 2 hr/day continue or 6 hr/day

Mean VA improvement at 10 weeks was 1.2 lines in the group that increased patching from 2 to 6 hours

- 0.5 lines in the group that continued with 2 hours of patching.

Among children in the increased patching dosage group, 40% showed at least 2 lines of VA improvement compared to 18% in the group who were to continue with patching for 2 hours
Amblyopia recurrence once treatment is discontinued

- 156 children <8 yo, who have been successfully treated for amblyopia (atropine or patching)
- Followed off treatment for 52 weeks to assess recurrence (2 or more logMAR level reduction)

■ Recurrence occurred in ~1/4 of the patients

■ Similar recurrence regardless of treatment
  - patching (24%) vs atropine (21%)

■ Data suggests greater recurrence in patients in which patching stopped abruptly rather than tapered
Poll Question #4

Your amblyopic patient has completed patching therapy. They have been patching OS 3 hours/day, 7 days/week and the vision is OD: 20/20 and OS: 20/20. What is your next step?

- A. Discontinue patching and have the patient return in 1 year for a comprehensive exam
- B. Discontinue patching and have the patient return in 3 months for a follow-up
- C. Taper patching to OS 2 hours/day, 4 days/week and have them return in 3 months
Treatment trial of amblyopia in children 7-17 yo

- 507 patients with VAs ranging 20/40-20/400
  - **Age groups:**
    - 7-12 yo
    - 13-17 yo

- Randomized to one of two groups:
  - *2-6 h/day patching with near activity*;
    - plus atropine in 7-12yo group
  - *Optical correction alone*

- “Responder” if improved in amblyopic eye by \( \geq 2 \) lines
ATS 3

Results:

■ Amblyopia improves with correction alone in 25% of entire group

■ 7-12 yo: treatment improved even if had previous treatment
  - 53% of treatment group were responders
  - 25% of optical group were responders

■ 13-17 yo: treatment improved if no previous amblyopia treatment
  - Responder rates were similar in both groups 25% vs 23%
  - However, if no previous amblyopia therapy 47% of treatment group were responders (vs 20% in optical group)
Microtropia

Also referred to as “Monofixation Syndrome”

- Visuoscopical
  - Stable and unsteady

- 4BO
  - Ex: (+) 4 BO OD = OD did not re-fixate

- Worth 4 Dot D and N
  - Normal at Near
  - Suppression at Distance

- Stereo
  - Reduced stereo at 5 ft with RDE
  - No RDS
  - May have slightly reduced WC
“Binocular iPad treatment for amblyopia in preschool children”

Evidence supports a role for binocular visual experience in the treatment of amblyopia

Dichoptic iPad games

50 amblyopic children 3-7 years of age

Play regular iPad games (n=5), binocular iPad games (n=45) for at least 4 hours per week for 4 weeks

- 30/45 children in treatment group also patched at different time of day
- 4/5 children in placebo group patched at different point in day

VA and stereoacuity assessed at baseline, 4 weeks and 3 months after game play
Binocular Treatment in Amblyopia

- Placebo group have no significant improvement in VA
- Treatment group, mean VA improved by about 1 line at 4 weeks
- Similar improvement despite type of amblyopia
- Children who played > 8 hours of dichoptic iPad games a week had significantly more VA improvement than children who played 0-4 hours
- No significant improvements in stereoacuity in either group
Who:
- Patients age 5-16 years with anisometric or strabismic amblyopia

What:
- Five visits to monitor visual acuity, stereoacuity and ocular alignment.

Why:
- To compare 1 hour a day, 7 days/week of binocular game play (on iPad) to 2hrs/day, 7 days/week of patching in improving visual acuity in amblyopic children.
Study Design/Objectives:

- Previous, short term studies have shown significant improvement in VA with binocular treatment approaches.

- For children aged 5-12, the study design is testing the hypothesis that binocular treatment with iPad games 1hr/day is non-inferior to patching for 2hrs/day.

- Benefits?
  - For children age 13-17, the study design is testing the hypothesis that binocular treatment with iPad games 1hr/day is superior to patching for 2hrs/day.
    - No proof that patching is more beneficial than refractive correction alone

- Duration: 16 weeks
Compliance

Why is compliance poor?
- Associated with poverty or social deprivation
- Parents not understanding the treatment
- When there is no improvement from treatment
- Mild anisometropic amblyopia
- Very severe amblyopia
- Older children

Patching?
- Social stigma
- Skin irritation
The Exam

Initial Workup (in addition to routine testing)

- VA
- Refractive error - dry and cycloplegic
- Cover test
- Stereopsis
- Fixation status
# The Exam

- Return visit after having worn glasses
- History aimed at probing compliance
- Lenso the glasses
- Repeat VA
- Dry retinoscopy/ Ret over glasses
- Repeat cover test
- Repeat stereo
- Repeat fixation status
- Accommodation and ocular motor measurements

*Repeat cyclo before all Rx changes or if improvement stalls*
Questions?

Thank you!
Email: JMallios@midwestern.edu