Update on Amblyopia Treatment: Evidence-based Practice

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No financial interests directly related to this presentation

A Case of Amblyopia

14 yo, Asian boy
cc: blury vision in the right eye, need new glasses.
Last eye exam: 9 months ago
VA cc: OD 20/40-             Rx: PI
OS  20/200                 +3.00
Cover Test cc: ortho Distance, ortho'
Stereo: (-) Random dot

A Case of Amblyopia

Dry Ret: OD: -1.00        20/20
OS: +5.75 - 0.50 x 180   20/80
Slit Lamp and DFE: WNL
Dx: Anisometropic amblyopia (OS)
More History: Patient had seen an eye doctor since he was 9 years old and saw the doctor every 6 months.
Mom was told her son had lazy eye and nothing could be done at his first eye exam (5 years ago). Rx with full power was not given otherwise he could not handle.
The doctor was taking summer vacation, so the patient came to us for Rx.

Amblyopia

- Dx of Amblyopia
- Tx of Amblyopia
  - Amblyopia Treatment Sequential
  - Tx of unilateral amblyopia vs. bilateral amblyopia
  - Vision Therapy in Amblyopia Treatment
- Tx in older children
- Recent Amblyopia Treatment Studies
- Amblyopia Treatment Prognosis
- Amblyopia Recurrence
- Recent Amblyopia Treatment Studies
- Tricks to successfully treat amblyopia
- Case discussion

Definition of Amblyopia

Amblyopia is the unilateral or bilateral decrease of best-corrected visual acuity caused by vision deprivation and/or abnormal binocular interaction, for which there is no pathology of the eye or visual pathway.

No 1 reason to cause visual impairment in children and young adults
Classification of Amblyopia

- Strabismic Amblyopia
- Anisometropic Amblyopia
- Isometric Amblyopia
- Stimulus Deprivation Amblyopia

Classification of Amblyopia

- Mild Amblyopia: better than 20/40
- Moderate Amblyopia: 20/40 to 20/100
- Severe Amblyopia: worse than 20/100

Is it easy to diagnose and treat amblyopia?

Amblyopia Decreased Best Corrected VA

Amblyopia Diagnosis

- Find the reasons which cause amblyopia
  
  Common
  - Strabismic Amblyopia
  - Refractive Amblyopia

Potentially Amblyogenic Refractive Errors

- Anisotropia
  - Hyperopia > +1.00
  - Astigmatism > 1.50
  - Myopia > -3.00

- Isometropia
  - Hyperopia > +5.00
  - Astigmatism > 2.50
  - Myopia > -8.00

* AOA Optometric Clinical Practice Guideline
  Consensus opinion & does not address if age dependent
**Risk of Bilateral Decreased VA Associated with Hyperopia**

MEPEDS/BPEDS: 5704 AA, Hispanic, White Children 30-72 months

<table>
<thead>
<tr>
<th>Bilateral SE Hyperopia</th>
<th>Odds Ratio*</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;0.0 D</td>
<td>1.37</td>
<td>0.63 – 2.99</td>
</tr>
<tr>
<td>0.0 to &lt;+1.0 D (reference)</td>
<td>1.0</td>
<td></td>
</tr>
<tr>
<td>+1.0 to &lt;+2.0 D</td>
<td>0.37</td>
<td>0.13 – 1.02</td>
</tr>
<tr>
<td>+2.0 to &lt;+3.0 D</td>
<td>1.02</td>
<td>0.36 – 2.85</td>
</tr>
<tr>
<td>+3.0 to &lt;+4.0 D</td>
<td>1.64</td>
<td>0.51 – 5.24</td>
</tr>
<tr>
<td>≥+4.0 D</td>
<td>11.45</td>
<td>5.01 – 26.18</td>
</tr>
</tbody>
</table>

Adjusted for age, astigmatism, gestational age.

*Significant Odds Ratio’s in bold. Level of hyperopia defined by least hyperopic eye.


**Amblyogenic Isoametropia**

<table>
<thead>
<tr>
<th></th>
<th>CPG*</th>
<th>PPP**</th>
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<tbody>
<tr>
<td>Astigmatism</td>
<td>&gt;2.50 D</td>
<td>≥2.00 – 3.00 D</td>
</tr>
<tr>
<td>Hyperopia</td>
<td>&gt;5.00 D</td>
<td>≥4.50 – 6.00 D</td>
</tr>
<tr>
<td>Myopia</td>
<td>&gt;8.00 D</td>
<td>≥3.00 – 5.00 D</td>
</tr>
</tbody>
</table>

*AOA Clinical Practice Guideline on Amblyopia; not address age
**Preferred Practice Pattern on Amblyopia. AmAcadOphthalmology
Consensus opinion only; PPP lower magnitude for children <2 years old

**Which Patients May Have Amblyopia?**

- **Patient # 1**
  - CT: 40 Δ IRET at distance, frequency 20%
  - 30 Δ IRET at near

- **Patient # 2**
  - CT: 30 Δ CAET at distance
  - 45 Δ CAET at near

- **Patient # 3**
  - CT: 8 Δ CRET at distance
  - 10 Δ CRET at near

**A case**

7 yo AA boy

- OD: +3.00-0.50 x 180 20/70
- OS: +2.25 20/20

CT: 10 Δ IRET, 16 Δ IRET (30% frequency)
Slit Lamp: WNL
DFE:
Amblyopia Diagnosis

- Rule out ocular pathology which can cause decreased vision
  - Optic nerve hypoplasia
  - Optic nerve atrophy
  - Optic nerve colobomas
  - Macular abnormalities

5 yo Hispanic girl

- OD: +0.50 -1.00 x 180  20/20-
- OS:  -2.50 -0.50 x 180   20/100
- Cover test: Ortho at distance and near
- Stereo: (-)
- Slit Lamp: WNL
- DFE:

Another case

- OD:  +0.50 -1.00 x 180  20/20-
- OS:  -2.50 -0.50 x 180   20/100
- Cover test: Ortho at distance and near
- Stereo: (-)
- Slit Lamp: WNL
- DFE:

Amblyopia Treatment

Evidence-based Practice!!

Another case

Dx
1. Optic Nerve Hypoplasia (OS)
2. Myopic Anisometropia

Tx: 3 months of direct patching (2 hrs/day)

Outcome:
1. BCVA improved from 20/100 to 20/40 OS
2. Stereo acuity improved from (-) to 50 arc sec with (+) random dot forms

Unilateral Amblyopia
Amblyopia Treatment Sequential

- Refractive correction
- Initiate Amblyopia Tx after Rx correction until VA is stable
- Follow-up every 1 to 3 months and progress evaluation
- End of Amblyopia Tx

Amblyopia Treatment

- Refractive correction
  - Accurate Rx is vital!!!!
  - Cyclo refraction for children and young adults

(Cyclo refraction for children and young adults)
- 1% Cyclopentolate two drops 5-min apart, check Rx in 30 min
- 0.5% Cyclopentolate for infant

How to Prescribe Rx for Amblyopes

Example:
6 yo girl
VA sc: 20/20 OD, 20/200 OS
CT: Ortho, 4° EP
Dry Ret: OD +0.50 20/20
OS +2.50 20/80
Cyclo Ret: OD +1.50 20/25
OS +4.50 20/80
Rx??

How to Prescribe Rx for Amblyopes

Example:
6 yo girl
VA sc: 20/20 OD, 20/200 OS
CT: Ortho, 8° EP
Dry Ret: OD +0.50 20/20
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Rx??

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Cyclo Ret: OD +1.50 20/25
OS +4.50 20/80
Rx??

Option #1: OD +0.50 OS +2.50
#2: OD +1.50 OS +4.50
#3: OD +0.50 OS +3.50
#4: OD PL OS +3.00

How toPrescribe Rx for Amblyopes

Example:
6 yo girl
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OS +2.50 20/80
Cyclo Ret: OD +1.50 20/25
OS +4.50 20/80
Rx??

Option #1: OD PL OS +3.50
#2: OD +1.50 OS +4.50
#3: OD +0.50 OS +3.50
#4: OD PL OS +3.00
with add +1.00

How to decide add power?
Amblyopia Treatment

- Refractive correction
- Initiate Amblyopia Tx after Rx correction
  - When?
  - Vision in amblyopic eye can improve just by Rx correction

Rx Correction (PEDIG Study Results)

Vision in amblyopic eye can improve just by Rx correction
- Amblyopia can be cured by just Rx correction in one third of the children (3-7 yo)
- Amblyopia improves by Rx correction in one fourth of the children (7 to 17yo)

Treatment Options

- Patching
- Atropine
  - Bangerter filter over the good eye
  - Over plus good eye

Recent Amblyopia Tx Studies

- Spectacle correction
- Patching vs. glasses
- Dose of patching
- Atropine
- Patching vs. Atropine
- Atropine daily vs. weekend
- Older children

Amblyopia in 3 to <7 Year Olds (PEDIG Study Results)

Moderate Amblyopia: 20/40 – 20/80
- Both atropine and patching are effective treatments
- Prescribing 2 hours or 6 hours of daily patching produces similar improvement
- Prescribing daily or weekend-only atropine produces similar improvement

Severe Amblyopia: worse than 20/80
- Prescribing 6 hours or full-time daily patching produces similar improvement

Why Atropine??

- Give parents/patients an alternative
  -- two clinical scenarios
- Easy to check compliance
Atropine may not work for every amblyopia patient

- Check near VA and fixation in the good eye
- Fixation (switching from good eye to amblyopic eye) is a good indicator that atropine should be effective to improve VA of the amblyopic eye
- PEDIG reported that weekend atropine can improve visual acuity in children 3 to 12 years of age with severe amblyopia
- Be careful with patient whose good eye is myopic

**Why Atropine??**

**An Example**

6 yo AA girl

- BCVA OD: -2.00 sph 20/20
- OS: +3.00 sph 20/60

Kids are much smarter than we thought!!

**Why Atropine??**

Make sure to educate parents/patients

- Atropine is only for the patient, not the whole family
- Side effect of atropine
  - light sensitivity (16%): ??summer camp???
  - flushing, fever (2.4%)

**A Case of Amblyopia**

14 yo, Asian boy

- Dry Ret: OD: -1.00 20/20
- OS: +5.75 - 0.50 x 180 20/80
- Slit Lamp and DFE: WNL
- Dx: Anisometropic amblyopia (OS)

More History: Patient had seen an eye doctor since he was 9 years old and saw the doctor every 6 months. Mom was told her son had lazy eye and nothing could be done 5 years ago. Rx with full power was not given otherwise he could not handle. The doctor was taking summer vacation, so the patient came to us for Rx.
Amblyopia in 7 to <18 Year Olds
(PEDIG Study Results)

- Amblyopia improves with optical correction alone in about 1/4 of patients; though most will require additional treatment.
- For 7 to <13 year olds, prescribing patching 2 to 6 hours/day with near activities and atropine can improve visual acuity even if the amblyopia has been previously treated.

Amblyopia in 13 to <18 Year Olds

- For 13 to <18 year olds, prescribing patching 2 to 6 hours/day with near activities may improve visual acuity when amblyopia has not been previously treated but appears to be of little benefit if amblyopia was previously treated with patching.
- Complete resolution of amblyopia is unusual even when there is a response to treatment.

Amblyopia Treatment

How often should amblyopic patients be followed up?

- Follow-up every 1 to 3 months and progress evaluation
  - Generally vision should improve after patching one month
  - Compliance, Compliance!!!

Amblyopia Treatment

What tests in the follow up exam?

- VA, same method
- Cover Test
- Stereo
  - suggest repeat refraction at least every 6 months

Treatment Prognosis

- Patient age
- Baseline VA
- Degree of anisometropia
- Compliance
One fourth of successfully treated amblyopes had a recurrence within the first year of Tx.
For subjects treated with 6 hr patch, taper to 2 hr patch decreased the chance of recurrence from 42% to 14%.
For subjects treated with 2 hr patch, the recurrence rate was 14%. All the subjects in this category had no taper.

Recurrence risk is similar for stopping patching and atropine.
Most recurrence occurs the first 3 months – suggest close f/u is critical.
“Taper/weaning” is beneficial for children aged 3 to 8 years.

Recurrence is 7%.
Amblyopia recurrence is rare in children 7-12 yo after discontinuing treatment other than spectacle wear.

“Taper/weaning” is beneficial for children aged 3 to 8 years with amblyopia Tx.
How to taper the amblyopia treatment?
• Severe amblyopia
• Moderate amblyopia

VA has no improvement or worse????

What should you do if VA has no improvement or worse?
• Compliance
• Lensometry
• Does patient look over the glasses?
• Patching the wrong eye
• Recheck Refraction
• Look for pathology

Example
Dis VA: 20/50
near cc: 20/25
20/20
**Compliance!!!!!!**

- If compliance of patching is poor, consider atropine
  - Patching = atropine
  - Limitation of atropine
- Re-educate the concept of amblyopia (example)
- Strategy to get children involved in patching
  -- Get children involved in the discussion and decision making process
  -- Give options
  -- Awards
  -- Flexible patching schedule - goal is the total time

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**Tricks to successfully treat amblyopia**

- Communication! Communication! Communication!
- Closely follow up
- Documentation

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**Bilateral Amblyopia**

- Aged 3 to 10 yo
- Mean VA at the enrollment: 20/63
- The cumulative probability of binocular VA of 20/25 or better (cured)
  - 21% 5 wks
  - 46% 13 wks
  - 59% 26 wks (Half year)
  - 74% 52 wks (1 year)

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**Bilateral Amblyopia: practice guideline changed**

- Alternating patching??
- Refractive correction only
- The rest 26%??

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**Enough Unilateral amblyopia?**
Vision Therapy for Amblyopia

- Reduced VA
- Reduced vision function
  - Contrast sensitivity
  - Accommodation
  - Suppression
  - Pursuit and Saccades
  - Space and distance detection
  - Stereoacuity
  - Size of visual span
  - Reduced crowding

Two questions
- Can VT improve VA in amblyopia patients?
- Is visual function normal when amblyopia is cured (clinical and research definition)? Does VT help improve visual function?

Vision Therapy Approach

- Near Activities
- Traditional Vision Therapy Approach
- Perceptual Learning
- Binocular Computer Activities

Near Activities for Amblyopia

A Randomized Pilot Study of Near Activities Versus Non-Near Activities During Patching Therapy for Amblyopia

- N = 80
- Conclusion: Performing near activities while patching helps improving VA in children with amblyopia

Near Activities for Amblyopia

A Randomized Trial of Near Versus Distance Activities While Patching for Amblyopia in Children Aged 3 to Less Than 7 Years

- N = 425, 3 to 7 yo
- Conclusion: Performing near activities while patching DOES NOT help improving VA in children with amblyopia
Traditional Vision Therapy Approach

- Pattern recognition/resolution activities
- Anti-suppression activities
- Accommodative activities
- Binocularity activities

Traditional Vision Therapy Approach

- Pattern recognition/resolution activities

Traditional Vision Therapy Approach

- Anti-suppression activities
- Red/green letter chart
- Cerioscopic tracing
- Antisuppression strips

Traditional Vision Therapy Approach

- Accommodative activities

Traditional Vision Therapy Approach

- Binocularity activities

Traditional Vision Therapy Approach

- No solid and good evidence
- General rules
  - Incorporate pattern recognition/resolution with patching or atropine treatment
  - I save office vision therapy for patients
  - BCVA does not reach 20/25 or better with patching or atropine treatment
  - Visual function is abnormal even BCVA 20/25 or better
Perceptional Learning for Amblyopia

Repeatedly practice a challenging task can lead to substantial and enduring improvement in visual performance over time.

What Do We Know about Perceptional Learning

- Perceptional learning improves visual functions both in children and adults
- Many studies found no age effect of perceptional learning on amblyopia treatment
- Perceptional learning is a type of training on a specific visual function. PL generally only partly transfers to Snellen acuity.

Limitations of Perceptional Learning

- Limited impact on clinical practice
- Limited transfer of trained visual function to VA and other visual functions
- Relative boring

Binocular Computer Activities for Amblyopia

Tetris game on iPad programmed for anti-suppression presentation
- Sound eye: lower contrast
- Amblyopic eye: higher contrast

Binocular Computer Activities for Amblyopia

- No results from randomized clinical trial. PEDIG is conducting one
- Several studies reported that binocular computer activities improve VA in both children and adults
Recent Clinical Trial in Amblyopia Treatment

- Randomization
- Double blinded
- Multiple clinical sites
- Big scale (subjects number)

ATS 10: Bangerter filter treatment

ATS-10 Lesson Learned

- Lower treatment burden with Bangerter filters compared to patching.
- Bangerter filter treatment is a reasonable option to consider when initiating treatment of moderate amblyopia.


Amblyopic Eye Acuity at 24 Weeks*

<table>
<thead>
<tr>
<th></th>
<th>Bangerter Group</th>
<th>Patching Group</th>
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<tbody>
<tr>
<td>Mean acuity at baseline</td>
<td>20/50−2</td>
<td>20/50−2</td>
</tr>
<tr>
<td>Mean acuity at 24 wks</td>
<td>20/32−2</td>
<td>20/32−2</td>
</tr>
<tr>
<td>Mean improvement from baseline at 24 weeks</td>
<td>1.9 lines</td>
<td>2.3 lines</td>
</tr>
<tr>
<td>Inter-ocular difference</td>
<td>2.3 lines</td>
<td>2.3 lines</td>
</tr>
</tbody>
</table>

* 93% follow up for both arms

ATS-13 Spectacles for Strabismic Amblyopia

Change in Visual Acuity Between Baseline & 18 Weeks

- % Improve ≥ 2 lines: Combined 69%, Strabismus 88%
- % Resolve*: Combined 28%, Strabismus 40%

Adjusted P = 0.003 from an ANCOVA

*Amblyopic eye visual acuity within 1 line of fellow eye acuity
ATS 13 Lesson Learned

- Optical treatment alone of strabismic and combined-mechanism amblyopia results in clinically meaningful improvement in amblyopic eye VA for most 3 to <7 year olds.
- Amblyopia resolves in at least 25% without the need for additional treatment.


Residual Amblyopia Younger Kids

- When stable does increasing the treatment improve the outcome?
  - ATS15 - at 2 hours per day, does increased patching help?
  - ATS16 – does adding plano to twice weekly atropine help?

ATS15 - Amblyopic Eye Visual Acuity Improvement

<table>
<thead>
<tr>
<th>Visit</th>
<th>Proportion with ≥ 2 logMAR line improvement since baseline</th>
</tr>
</thead>
<tbody>
<tr>
<td>10-Week Outcome</td>
<td>18%</td>
</tr>
<tr>
<td>Best Post-Randomization</td>
<td>2-Hour: 40%</td>
</tr>
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A Case of Amblyopia

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OS: +5.75-0.50 x 180 20/80
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Dx: Anisometropic amblyopia (OS)

More History: The patient has seen an eye doctor since he was 9 years old and continue to see that doctor every 6 month. Patient was told he has lazy eye and nothing could be done 5 years ago. The glasses was not given the full power otherwise he could not handle. The doctor is taking summer vacation, so the patient came to us for Rx.

A Case of Amblyopia

Lessons from this case

- Amblyopia can be treated in 9 yo children.
- Patient needs full correction of anisometropia, not partial correction of anisometropia.

Cyclo: OD: -0.75 20/20
OS: +5.75 - 0.50 x 180 20/50
Tx: Fit patient with Focus Night & Day OS/ 8.4/ +5.50 20/30-2
Case Discussion

Case #1

5 yo, AA boy
CC: Mom noticed right eye drifted in sometimes.
VA sc: OD: 20/20- OS: 20/100-
CT: ortho at D and 20 IET at near
Stereo: 3/3 animal
Dry Ret
OD: +1.00  20/30+
OS: +3.00  20/80+
MR: OD: +0.50  20/25+ OS: +2.50  20/80-
CT cc: ortho at D and 4 EP
Cyclo Ret: OD: +1.50  20/25
OS: +4.00  20/60

If this patient has no IET, Rx: OD: pl
b/c IET, final Rx: OD: +1.00
OS: +3.50

Case #2

Just Amblyopia?

7 yo, white boy
Hx and CC: Patient was diagnosed with amblyopia in the left eye at age of 4 and tried patching for 1.5 years in another clinic with fair compliance. Mom wanted to see if his vision could further improve.
CT: ortho N and D
Cyclo Ret
OD: +1.50-0.50 x 180  20/40
OS: +5.25  20/60
Case #2  Just Amblyopia?

OD: +1.50-0.50 x 180  20/40  
OS: +5.25   20/60

Dx: 1. Anisometropic Amblyopia (OS)  
2. Optic nerve hypoplasia (OD)

Case #3: How Easy to Treat Amblyopia?

- KB, 6 yo Hispanic girl, fail school screening. First eye exam 
- VA: 20/60 OD, 20/20 OS 
- CT sc: ortho at distance, 6 EP' 
- EOM: full 
- Ref: +2.50  20/60+3 OD 
  +0.75  20/20 OS 
- Cyclo: +5.50  20/60 OD 
  +2.00  20/20 OS 
- Rx: OD +4.50 
  OS +1.00 
- Tx: full time wear glasses 
  RTC 1 month after wearing Rx

Case #2

Check Rx

Patch the wrong eye!!

The best VA for this patient was 20/40+2 before lost follow up.

- Patient came back 6 months later, “It took 4 months to 
  get glasses from Medaid”. Dad stated that patient wore 
  glasses all the time. 
- VA: 20/60+3 OD, 20/20+1 OS 
- CT: ortho at dis and near 
- Over ref: pl OD, OS 
- Tx: wear glasses full time 
  patch left eye 3 hr/day with near activities 
  RTC one month for F/U

- Patient missed the appointment on 12-2005 and came 
  back on 02-2006, “we were busy during the holiday.”
- “How often do you patch your eye?”
  Dad : sometimes  Patient: never 
- VA: 20/50+3 OD, 20/20-1 OS 
- Re-educate the important of patching. RTC in 1 month 
  VA: 20/70-3 OD, 20/20 OS
Case #4
JG, 13 yo AA M
• Ret: OD: -3.00-0.25 x 180  20/20
  OS: -14.50-1.50 x 180   20/400
  Fitted with Acuve Oasys  -3.00, 8.4 OD    20/20
  -12.00, 8.4 OS    20/300
  Rx OD: pl
  OS: pl-1.00 x 180
  Refer to Peds for Amblyopia Tx

Case #3
10 months later, follow up in Peds
• VA cl: OD: 20/20
  OS: 20/400 at 5 ft
  Patient did not wear glasses
  Slit lamp: OD: -360° cornea neo
  OS: WNL

Case #3
No CL in the left eye.
Why?
Save money!!!!!!!!!!!!
Sleep CL in the right eye.
Current CL 2-3 months old

Case #3
JG
Ret: OD: -3.00-0.25 x 180  20/20
  OS: -14.50-1.50 x 180   20/400
  Aniso: -10.50 D
  Fit with Acuvue Oasys 8.4, -10.00
  Rx the rest
  My suggestions:
  • Correct the aniso by CL if aniso > 3 D
  • Rx with polycarbonate material

Final Words on Amblyopia
• Kids are fun to work with
• Constant fighting during the Tx
• Rewarding in the end
• We can really change a person’s life

Thank you!!!!!
Questions?
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