Amblyopia Treatment using ACRONYMS

Lionel Kowal
Royal Victorian Eye and Ear Hospital
Melbourne, Australia
What is amblyopia?

- Reduced vision
- Normal morphology
- Reversible

BUT .... the harder we look the more often we find something structurally wrong – significance unknown / evolving
OCT, amblyopia, and congenital disc deformities.

Optic disc area and retinal area in amblyopia.

Retinal area and optic disc rim area in amblyopic, fellow, and normal hyperopic eyes: a hypothesis for decreased acuity in amblyopia.
Ophthalmology. 2008 Dec;115(12):2259-61
Retinal nerve fiber layer thickness in amblyopic eyes.

The axial length/disc area ratio in anisometropic hyperopic amblyopia: a hypothesis for decreased unilateral vision associated with hyperopic anisometropia
Ophthalmology. 2004 Feb;111(2):304-8
Changes in pts with amblyopia

Axial length-disc area ratio in esotropia amblyopia

Optic nerve hypoplasia and small eyes in presumed amblyopia.

Dysversion of the optic disc and axial length measurements in a presumed amblyopic population
Bilateral Abnormalities of Optic Nerve Size and Eye Shape in Unilateral Amblyopia

STACY L. PINELLES AND JOSEPH L. DEMER

CONCLUSIONS: Unilateral amblyopia is associated with bilaterally, but also with subclinically hypoplastic ONs, greater than normal AL/ON, and abnormally noncircular globe cross-section. These factors evidently do not determine which of the 2 eyes will become amblyopic. Reduced circularity of amblyopic and fellow eyes may reflect optical causes of amblyopia or bilateral dysregulation of globe shape secondary to amblyopia. (Am J Ophthalmol 2009;148:551–557. © 2009 by Elsevier Inc. All rights reserved.)
Macular thickness of those whose BCVA **improved** after amblyopia treatment c.f. those who **didn’t** improve

<table>
<thead>
<tr>
<th>VA</th>
<th>Dx</th>
<th>Final VA</th>
<th>OCT mac</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Right</td>
<td>Left</td>
<td>Right</td>
</tr>
<tr>
<td><strong>Improvement with Rx</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>6</td>
<td>28</td>
<td>6</td>
</tr>
<tr>
<td>2</td>
<td>9</td>
<td>120</td>
<td>6</td>
</tr>
<tr>
<td>3</td>
<td>180</td>
<td>8</td>
<td>15</td>
</tr>
<tr>
<td>4</td>
<td>30</td>
<td>6</td>
<td>18</td>
</tr>
<tr>
<td>5</td>
<td>12</td>
<td>360</td>
<td>12</td>
</tr>
<tr>
<td>Avg</td>
<td></td>
<td></td>
<td>176</td>
</tr>
</tbody>
</table>

| **No improvement with Rx** |        |        |       |      |      |       |
| 1   | 12     | 24     | 12    | 24  | 226 | 136  |
| 2   | 6      | 60     | 6     | 60  | 292 | 177  |
| 3   | 6      | 24     | 8     | 45  | 193 | 152  |
| 4   | 6      | 30     | 9     | 30  | 276 | 169  |
| 5   | 19     | 30     | 12    | 24  | 242 | 238  |
| 6   | 45     | 9      | 45    | 9   | 207 | 160  |
| 7   | 90     | 9      | 120   | 7   | 232 | 191  |
| Avg |        |        | 238.2857 | 174.7143 | 0.0063 |       |

**paired t-test**: 0.2427

**CI**: 218 ± 21 173 ± 13
2 Key Guidelines for Amblyopia Treatment

• Use treatment (s) that is effective for this child

• Don’t persist with ineffective treatment
Same old Questions

- What treatment?
- How much treatment?
- For how long?
- When shouldn’t we?
- What other treatment?
- What if it doesn’t work?
- When / how do we stop?

**ANSWERS:**
**HAVE BEEN EMINENCE DICTATED**
**IOWA ≠ BALTIMORE 2009:**
**NOW SHOULD BE EVIDENCE BASED**
‘Evidence based’

PEDIG
• Pediatric Eye Disease Investigator Group

MOTAS
• Monitored Occlusion Treatment of Amblyopia Study
PEDIG

• Large study numbers / many studies

• Can do reliable HOTV

• Prescribed treatment dose monitored by parent diaries
MOTAS

- Smaller numbers
- Rigorous monitoring of patching dose with Electronic Occlusion Dose Monitor (ODM)
How good are parent diaries?

...overestimate actual patching time (by 2 or 3) when monitored with ODM, even when parents know the diary will be checked
PEDIG: Glasses alone

• 6/12 to 6/75
• 27% cured
• Another 50% ≥ 2 lines better
• Took up to 7 mo
• 65 newly diagnosed children

• VA improved (p 0.001) from 0.67 [6/24-] to 0.43 [6/15-]

‘REFRACTIVE ADAPTATION’

*is this why the CAM stimulator ‘worked’?
• VA 6/30 to 6/120
• 6h/d vs all waking hours
• 4mo: 4+ line improvement

• VA 6/12 to 6/24
• 2h vs. 6h/d
• 4mo: 2.4 line improvement

Age and severity of amblyopia not relevant
VA 6/12 to 6/24  ~75% get better

Daily atropine vs. patch 6h/d
• 6 months and 2 years: no difference

Daily vs weekend Atropine
• 1/80 Occlusion amblyopia

Atropine and reduced plus
• No benefit cf atropine alone
• Increased risk of occlusion amblyopia
Is atropine better than patching for some children?

• Q’aire:
  parents who had used both atropine and occlusion at different times for their child

• 2/3 prefer atropine

• Does ↑preference mean better compliance → better effect?

KOWAL UNPUBLISHED
Recurrence of amblyopia

- 25%: ≥ 2 lines loss @ 12mo
- 15% in first 6 months
- 10% in second six months
- 42% after stopping 6h/d
- 14% if 6h/d tapered to 2h/d before stopping
Recurrence of amblyopia

1 year follow-up

<table>
<thead>
<tr>
<th>Amblyopia Type</th>
<th>Vision loss</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mixed</td>
<td>1 line (5 letters)</td>
</tr>
<tr>
<td>Anisometropic</td>
<td>1 letter</td>
</tr>
<tr>
<td>Strabismic</td>
<td>2.5 letters</td>
</tr>
</tbody>
</table>
### VA 6/12 – 6/120

**Glasses vs. glasses plus**

<table>
<thead>
<tr>
<th>Age Range</th>
<th>Treatment Details</th>
<th>Improvement Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>7-12 year old</td>
<td>• patch 2-6h/d &amp; daily atropine&lt;br&gt;• Acuity improved by ≥ 2 lines&lt;br&gt;• ~ 50% get better</td>
<td></td>
</tr>
<tr>
<td>13-17 year old</td>
<td>• patch 2-6h/d&lt;br&gt;• Some improve&lt;br&gt;• 12mo later: 20% have regressed&lt;br&gt;• ~ 25% get better</td>
<td></td>
</tr>
</tbody>
</table>
MOTAS

- 18w of glasses
- Then patch prescribed (6h c.f. 12h/d)
- **6h/d**: received 4.2 [± 0.5] h/d
- **12h/d**: received 6.2 [± 1.1] h/d
Percentage of amblyopia deficit corrected

<table>
<thead>
<tr>
<th>Type</th>
<th>Ref. Adapt.</th>
<th>Occl.</th>
<th>Deficit corrected</th>
</tr>
</thead>
<tbody>
<tr>
<td>All</td>
<td>32</td>
<td>47</td>
<td>78</td>
</tr>
<tr>
<td>Aniso</td>
<td>44</td>
<td>42</td>
<td>86</td>
</tr>
<tr>
<td>Strab</td>
<td>30</td>
<td>50</td>
<td>80</td>
</tr>
<tr>
<td>Mixed</td>
<td>27</td>
<td>50</td>
<td>77</td>
</tr>
</tbody>
</table>
Dose response allows planning to maximise the hours of therapeutic and effective patching & minimise the hours of ineffective patching.

<table>
<thead>
<tr>
<th>AGE</th>
<th>DOSE</th>
</tr>
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<tbody>
<tr>
<td>&lt; 4 years</td>
<td>Less than 3h/d effective&lt;br&gt;Minimal additional gains with &gt;3 h/d</td>
</tr>
<tr>
<td>&gt;4 years</td>
<td>Significant difference between &lt;3 and 3 - 6 h/d&lt;br&gt;No difference between 3-6 and 6- 12 h/d</td>
</tr>
<tr>
<td>&gt;6 years</td>
<td>Less than 3 h/d had little effect&lt;br&gt;Need &gt; 3 h/d</td>
</tr>
</tbody>
</table>
Treatment effects

1 line gain:
• needs ~ 120h occlusion

2 line gain:
• 4y: needs 170h
• 6y: needs 236h
Scott:

**MUCH more is always better?**

- All patients: full-time occlusion
- Success: 20/30 or better or equal VA by fixation pattern.
- 600 pts followed up after cessation of FT patching [mean 7y].
- 89% followed > 1 y.
EXCEPTIONAL Results

- 96% attained “success”.
- 60%: equal visual acuity.
- 6/12 - 6/30 : 6/9 or ≥ 3 lines improvement:
  PEDIG ~80%, Scott 98%
- Younger: less occlusion time to endpoint &
  better visual outcome (P = 0.0001).
- Incidence of occlusion amblyopia was 26%.
  Nearly all treatable.
<table>
<thead>
<tr>
<th></th>
<th>Number</th>
<th>Lost to FU</th>
<th>Strab</th>
<th>Aniso</th>
<th>Mixed</th>
</tr>
</thead>
<tbody>
<tr>
<td>PEDIG</td>
<td>419</td>
<td>5 – 10 %</td>
<td>38%</td>
<td>37%</td>
<td>24%</td>
</tr>
<tr>
<td>Scott</td>
<td>600</td>
<td>19%</td>
<td>73%</td>
<td>9%</td>
<td>17%</td>
</tr>
</tbody>
</table>
MOTAS: More isn’t always better

• Higher dose rates achieve the best outcome more rapidly but at a risk of accumulating excessive non-therapeutic hours of patching....patching for all waking hours is almost certainly excessive....
Q: Strabismic Amblyopia

• Does alignment result in better response to amblyopia therapy?...or no need for amblyopia therapy?
Timing of amblyopia therapy relative to strabismus surgery

- 47 children < 8y with both amblyopia & esotropia.
- 26 : amblyopia fully treated before surgery
- 21 : surgery before completing amblyopia therapy.
- 5/21 did not require amblyopia therapy after surgery even though they were still amblyopic before operation.

Lam GC et al Ophthalmology Dec 1993
When it seems not to be working for your patient: maybe it IS working

It IS working but the 3 yo won’t do vision tests properly.

LE doesn’t get to Allen pix 6/30 BUT:
• Now accommodates for near
• It used to take +6 extra RE to cause fixation switch, now +3 will do it
• Now functions normally with patch on

*Sweep VEP* can help doctor and parent anxiety
When it doesn’t work for your patient: is it the Parents?

• Parents dislike parading an obviously defective child

• Parents don’t like inflicting discomfort on their child
Types of parents ......

• stopwatch parents
  on Thursday we only did 5h 20m, so we made up for it on Friday with 6h 40m

• average parents – type 1
  We’re careful to do it all the time.. but we forget sometimes when we’re busy....

• average parents – type 2
  s/he hates it.... we haven’t managed for the last week.... s/he was sick... we were on vacation... we let the nanny look after it.... s/he only does it @ school...

• invisible parents
  Don’t keep appointments
Helping the parents: create a Therapeutic Environment

• Some parents need help to maintain enthusiasm for a task which every parent finds difficult

• Keep the therapeutic environment alive / active e.g. ring daily
Post Darwinian treatments

*Erasmus Darwin (1731 – 1802)*

- Refractive surgery
- Drugs
Refractive surgery

- Surgical safety established
- Anisometropia and Ametropia - Encouraging results
- Selected patients
- All publications have selection bias
## Results

<table>
<thead>
<tr>
<th>L. Tycheson</th>
<th>W. Astle</th>
</tr>
</thead>
<tbody>
<tr>
<td>260 patients</td>
<td>56 eyes (39 patients)</td>
</tr>
<tr>
<td>90% within 1.5 D of emmetropia</td>
<td>Mean SE -1.73 D</td>
</tr>
<tr>
<td>50% improved fusion and stereopsis</td>
<td>VA improved 1 – 7 lines</td>
</tr>
<tr>
<td></td>
<td>No significant improvement in stereopsis</td>
</tr>
</tbody>
</table>
Drugs

• Levodopa (PEDIG pilot study)
• Citicholine

• Anecdotally helpful in some cases of resistant amblyopia

• Prozac – Restores plasticity in rat adult visual cortex  *Science 320,385 (2008)*
Observation on therapeutic effect of auricular point sticking combined with Tongshiji treatment on child ametropic amblyopia [Zhongguo Zhen Jiu. 2008 Apr;28(4):270-2]

CONCLUSION:
• Auricular point sticking combined with Tongshiji treatment for child ametropic amblyopia .... convenient manipulation, obvious and rapid therapeutic effect.
Thank you

- BIPOSA for inviting me
- 3 days of presenters for lots of interesting information
- Glasgow for its hospitality, warmth and good shopping