SO…. AMBLYOPIA, WHAT'S NEXT?

ELISSE HIGGINBOTHAM

LEARNING OBJECTIVES

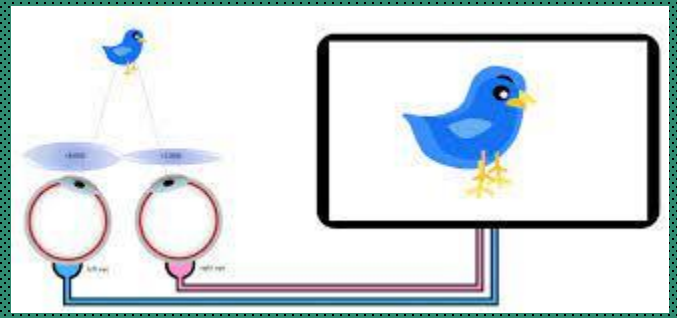
1. Explore longitudinal data to better understand the long-term process of amblyopia treatment, as it affects the child throughout
2. Understand the impact of compliance on time course of treatment and success.
3. Explore the recent evidence regarding binocular therapy for amblyopia

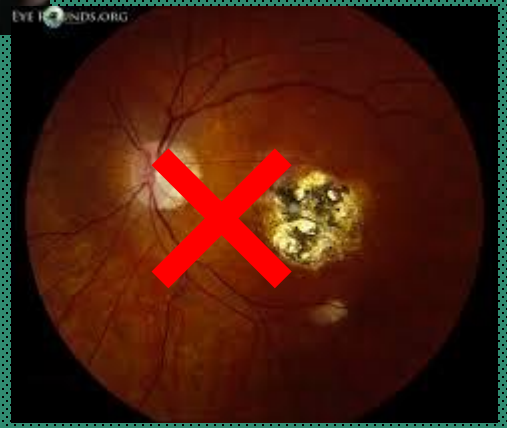
THE PROBLEM

What is the problem?	• Children have preventable vision loss
Who has this problem?	• Children and children who become adults
Why should this problem be solved?	• Lifetime increased risk of vision impairment
How will I know this problem has been solved?	• Their vision is equal or close to equal • Their eyes are straight • Their visual function is normal in both eyes • QOL and anxiety re loss of vision are addressed

AMBLYOPIA

- Difference of 2 lines of vision (this may be 6/3 and 6/4.8)*
- **An amblyogenic factor must be present – strabismus or anisometropia**
- An ABSENCE OF OTHER ORGANIC CAUSE – must rule out disease





PREVALENCE OF AMBLYOPIA

Influence of prenatal environment and birth parameters on amblyopia, strabismus, and anisometropia

Gareth Lingham, MOrth,[a] David A. Mackey, MD, FRANZCO,[a] Paul G. Sanfilippo, PhD,[a,b] Jenny Mountain, MClinEpi,[d] Alex W. Hewitt, PhD, FRANZCO,[a,b,c] John P. Newnham, MD, FRANZCOG,[c] and Seyhan Yazar, PhD[a]

PURPOSE To report the prevalence of amblyopia, strabismus, and anisometropia in a young adult population at a single center in Australia and to investigate the underlying prenatal and early-life risk factors.

METHODS Participants in the Raine Study have been followed from mid-gestation (n = 2,868 newborns) to young adulthood. At age 20 years, 1,344 participants had a comprehensive eye examination, including visual acuity and a detailed orthoptic assessment. Risk factors were determined from medical records and questionnaires completed by the mothers at 18 weeks' gestation. The main outcome measures were the proportions of participants with amblyopia, esotropia, exotropia, or anisometropia (defined as >1 D difference).

RESULTS Of the 1,125 white participants, 12 (1.1%) had amblyopia, 39 (3.5%) had strabismus, and 33 (2.9%) had anisometropia. In multivariable logistic regression, amblyopia was associated with a maternal history of pregnancy-induced hypertension (OR = 3.80; 95% CI, 1.19-12.13); esotropia, with lower gestational age (OR = 0.97; 95% CI, 0.95-0.97) and a heavier placenta (OR = 1.02; 95% CI, 1.00-1.04); exotropia, with a maternal history of pre-

- 0.5-4% depending on study location and source (ie school screening vs hospital)

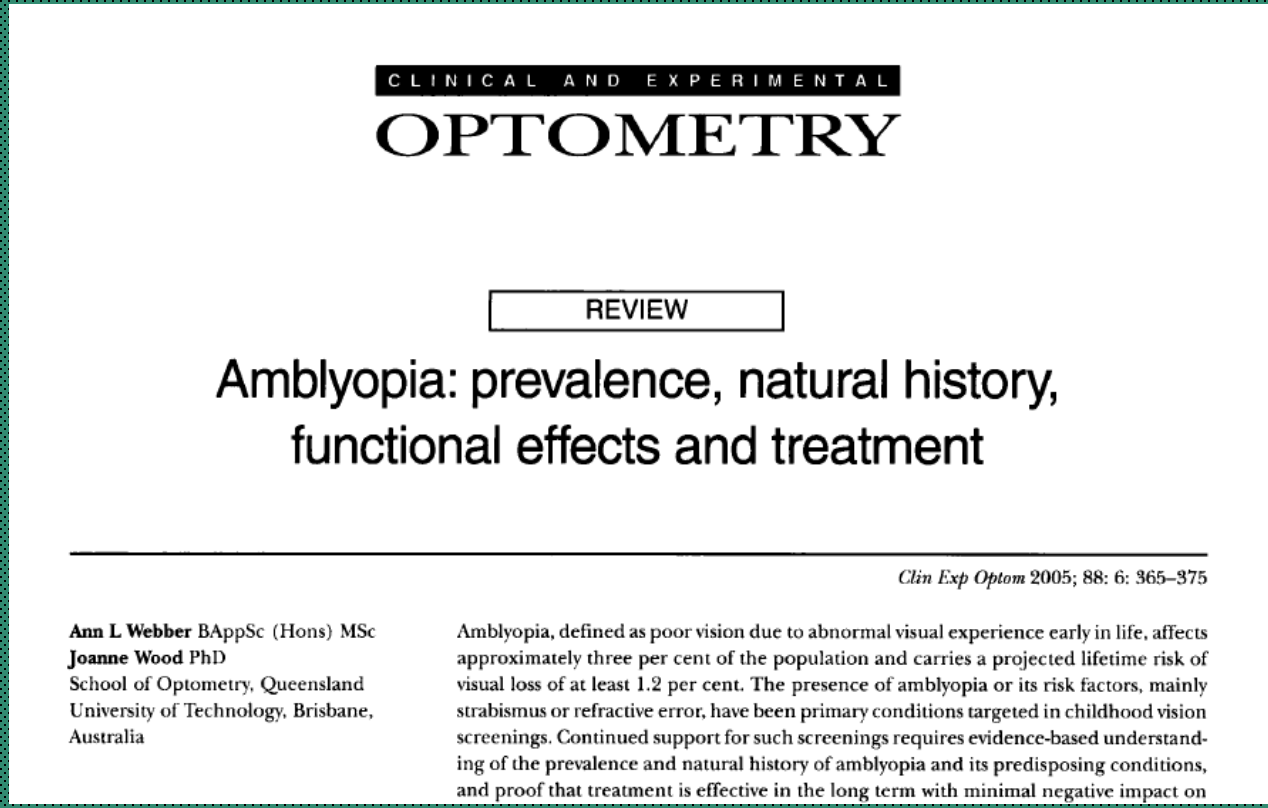
In Perth: 1.1% (3.5% strabismus, 2.9% anisometropia) (20yo)

Raine Study 2020: J AAPOS 2020;24:74.e1-7

RISK FACTORS FOR DEVELOPING AMBLYOPIA

- **Strabismus:**
  - **Esotropia>>> Constant Exotropia >> ?Divergence Excess Exotropia??**
- **Anisometropia**

- Prematurity, small birth-weight 4x increased risk of amblyopia
- ?Maternal smoking
- Family history of amblyopia (1st degree relative)



CLINICAL AND EXPERIMENTAL
OPTOMETRY

REVIEW

Amblyopia: prevalence, natural history, functional effects and treatment

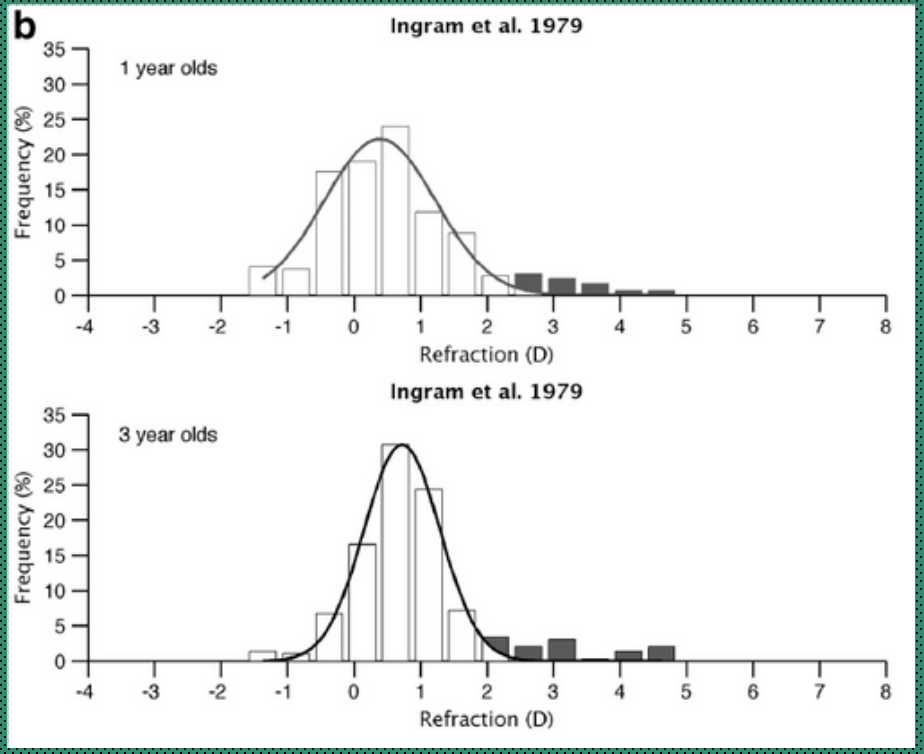
Clin Exp Optom 2005; 88: 6: 365–375

Ann L Webber BAppSc (Hons) MSc
Joanne Wood PhD
School of Optometry, Queensland University of Technology, Brisbane, Australia

Amblyopia, defined as poor vision due to abnormal visual experience early in life, affects approximately three per cent of the population and carries a projected lifetime risk of visual loss of at least 1.2 per cent. The presence of amblyopia or its risk factors, mainly strabismus or refractive error, have been primary conditions targeted in childhood vision screenings. Continued support for such screenings requires evidence-based understanding of the prevalence and natural history of amblyopia and its predisposing conditions, and proof that treatment is effective in the long term with minimal negative impact on

RELATIONSHIP TO REFRACTIVE ERROR

- Hyperopia >+3.5 (13x risk of strabismus, 6x acuity asymmetry)
- Aniso > +1.0
- Myopia aniso >5D? (Leat says 2D)
- Astigmatism > 2.5D (1.5D if oblique)?



Leat 2011, To prescribe or not to prescribe? Guidelines for spectacle prescribing in infants and children. Clin Exp Optom 94:6:514-527

LIFETIME RISK

- Reduce risk to good eye
- Quality of life

SCIENTIFIC REPORT

Risk of bilateral visual impairment in individuals with amblyopia: the Rotterdam study

Redmer van Leeuwen, Marinus J C Eijkemans, Johannes R Vingerling, Albert Hofman, Paulus T V M de Jong, Huib J Simonsz

Br J Ophthalmol 2007;**91**:1450–1451. doi: 10.1136/bjo.2006.113670

Background: The excess risk of bilateral visual impairment (BVI; bilateral visual acuity <0.5) among individuals with amblyopia is an argument for screening for amblyopia, but data are scarce.
Methods: The risk was estimated by determining the incidence of BVI in the Rotterdam Study, a population-based cohort of subjects aged 55 years or over (n = 5220), including 192 individuals with amblyopia (3.7%). Using a multistate lifetable, the lifetime risk and excess period spent with BVI were determined.
Results: The relative risk of BVI for amblyopes was 2.6 (95% confidence interval 1.4–4.5). For individuals with amblyopia, the lifetime risk of BVI was 18%, whereas they lived on average 7.2 years with BVI. For non-amblyopic individuals, these figures were 10% and 6.7 years, respectively.
Conclusion: Amblyopia nearly doubles the lifetime risk of BVI and affected individuals spent an extra six months with BVI. This study provides data for future cost-effectiveness analyses.

The risk of losing vision in the non-amblyopic eye, as well as the social and psychological benefit of binocularity, is an important reason for the prevention and treatment of amblyopia in children. Few data exist on this risk, however, despite a prevalence of amblyopia of approximately 2.5% in the general population.[1] Tommila and Tarkkanen[2] in Finland identified 35 individuals over a 20-year period with amblyopia who had lost vision in their non-amblyopic eye. Rahi *et al*.[3] recently performed a prospective national surveillance among ophthalmologists in the United Kingdom and found 370 cases. According to this study, the projected lifetime risk of vision loss (visual acuity <0.5) for an individual with amblyopia was at least 1.2%. It is possible, however, that both surveillance studies underestimated this risk because the population at risk was not known precisely and elderly patients who did not visit an ophthalmologist may

At baseline, participants underwent an interview at their home followed by an extensive general medical and ophthalmological examination at the research centre. Visual acuity was measured monocular at a 3 m distance using a Lighthouse Distance Visual Acuity Test, a modified Early Treatment Diabetic Retinopathy Study chart.[6] To evaluate best-corrected visual acuity, optimal refraction was obtained subjectively after objective autorefraction. Individuals reporting an amblyopic eye were selected (n = 137), as well as those with a unilateral visual acuity less than 1.0 as a result of amblyopia according to a trained examiner (n = 97). The diagnosis of amblyopia was assumed to be correct when one of the following criteria was present (n = 185): a unilateral visual acuity of 0.5 or less and (history of) strabismus, or anisometropia greater than 1 dioptre, or hypermetropia greater than 3 dioptres in the least hypermetropic eye, or astigmatism greater than 1.5 dioptres, and no other explanation for unilateral visual acuity of 0.5 or less. Eight individuals with a possible history of amblyopia who did not match the criteria were re-examined in person by an ophthalmologist; the diagnosis was confirmed in seven.

BVI was defined as a best-corrected visual acuity less than 0.5 in the better eye, without improvement at subsequent examinations. This cut-of value is in accordance with the United States criteria for visual impairment and is the same as that used in the Rahi study.[3] The age-specific incidence rate of BVI was determined by dividing the number of incident cases by the number of person-years within an age category. A Poisson model was fitted to the data to model the age-dependent prevalence and incidence of BVI. Next, a Markov multistate life-table was constructed with transition probabilities from the Poisson model. Mortality rates were taken from the Dutch national database for statistics. From this analysis the age-specific prevalence rates, the cumulative (lifetime) incidences, and the remaining years with BVI were obtained.

IN AUSTRALIA

Table 4. Causes of Uncorrected Visual Acuity Less than 20/40 in at Least

Cause	Visual Acuity <20/40 n (%)		Visual Acuity <20/40 in at Least One Eye n (%)
	Right Eye	*Left Eye*	
Refractive error	32 (74.4)	35 (74.5)	49 (69.0)
Myopia only	5 (11.6)	5 (10.6)	5 (7.0)
Myopia and astigmatism	5 (11.6)	5 (10.6)	6 (8.5)
Hyperopia only	8 (18.6)	5 (10.6)	11 (15.5)
Hyperopia and astigmatism	7 (16.3)	7 (14.9)	10 (14.1)
Astigmatism only	7 (16.3)	13 (27.7)	17 (23.9)
Amblyopia	7 (16.3)	9 (19.1)	16 (22.5)
Corneal opacity	0 (0.0)	0 (0.0)	0 (0.0)
Lens opacity	0 (0.0)	0 (0.0)	0 (0.0)
Retinal disorder	1 (2.3)	2 (4.3)	2 (2.8)
Presumed poor cooperation	3 (7.0)	1 (2.1)	4 (5.6)
All causes	43 (100.0)	47 (100.0)	71 (99.9)

Robaei 2005 Ophthalmology 112:1275-1282

Children with poor vision due to eye disease are rare.

Most are picked up in hospitals as part of newborn screenings and will not present to you.

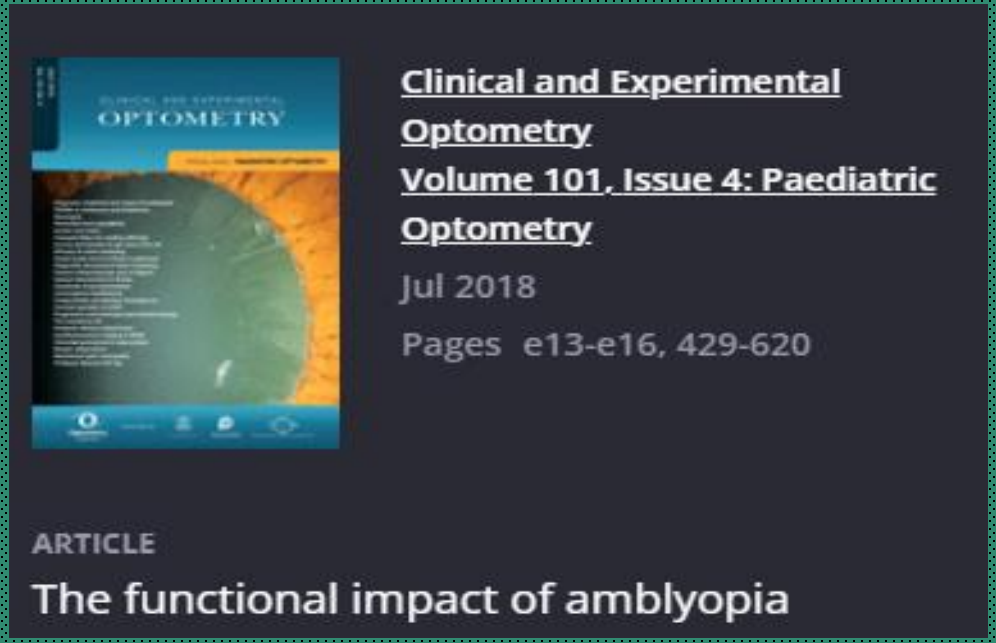
If cataract, ROP, organic lesions, cortical issues. → Refer for ophthalmological opinion if not seen already.
We can't do anything about these (low vision supports as needed).

However - we CAN do something about the amblyopes.

AMBLYOPIA IS NOT JUST LOSS OF ACUITY

It also affects your:

- localisation
- contrast
- accommodation
- visual motor function
- visual attention
- academic performance at school
- likelihood of going to uni
- chance of losing vision in the good eye



Chua B, Mitchell P. Consequences of amblyopia on education, occupation, and long term vision loss. Br J Ophthalmol 2004; 88: 1119–1121.

OUR CAST OF CHARACTERS

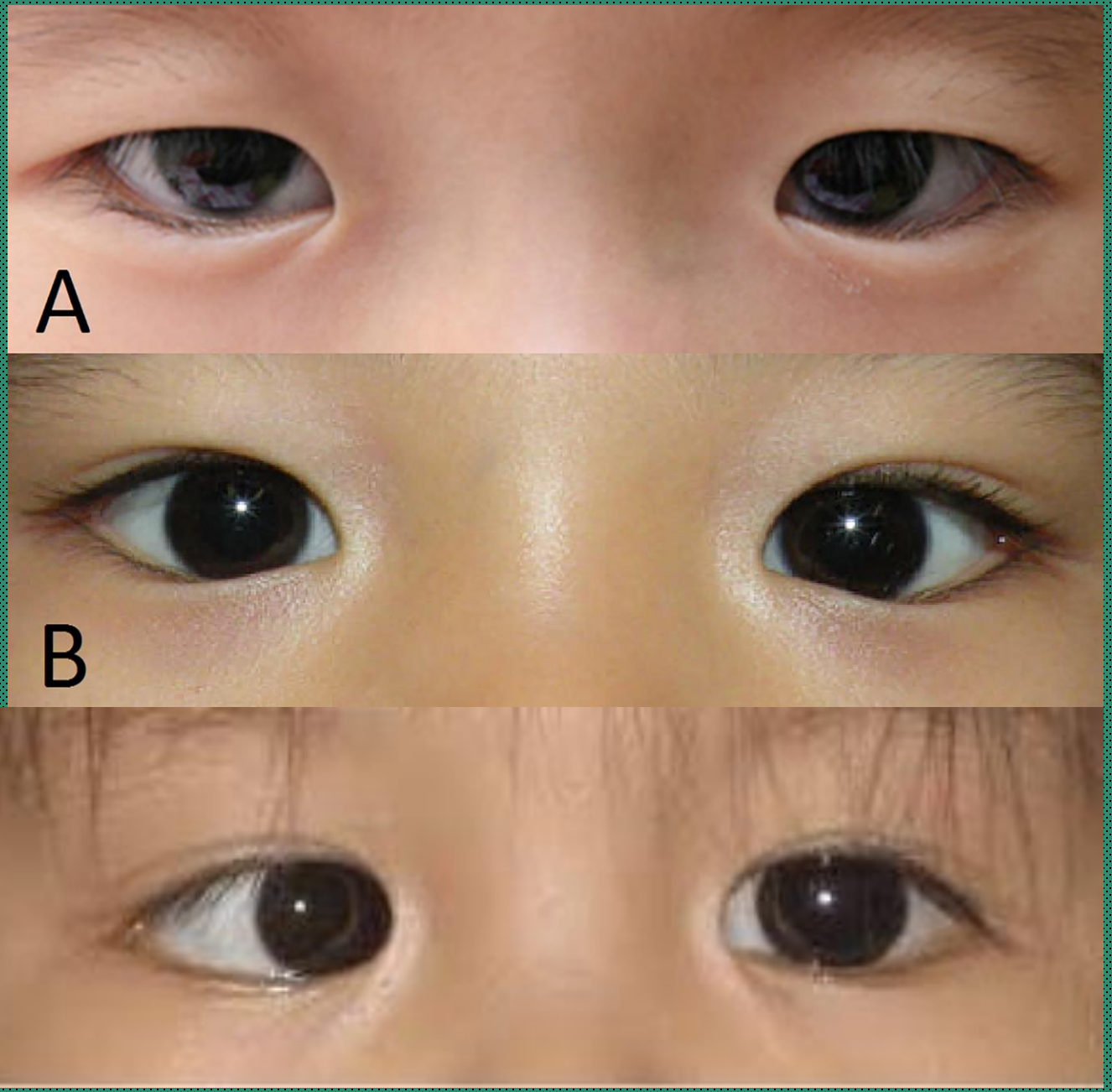
Anne B
Age 3

Leo
Age 5

Pia
Age 10

ANNE B – AGE 3

"I think my daughter's eyes are turning. I used to notice it more when she was younger, but she has just started at childcare and now other people are commenting on it too".



ANNE B: QUESTIONS?

Q1 Is the eye turning(Always/sometimes/never)
(if so, which eye)

Q2 Is amblyopia present?

Q1 – IS THE EYE TURNING?

Two issues: Cosmesis vs impact on function

Robaei study: Visual impairment was significantly more common in children with (22.9 per cent) than without (1.3 per cent) strabismus ($p < 0.0001$)

If parent says eyes turn, but you think they look straight

→ epicanthus

but: 30% dx w esotropia later

Ask: do you think they are turning TODAY?

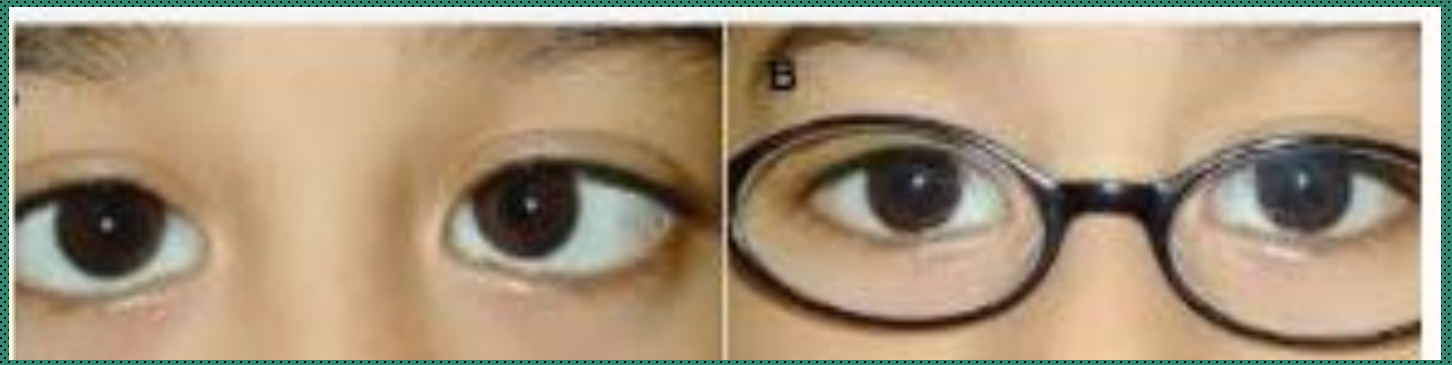
- If you both agree the answer is no, it is more likely that the eye really is turning at home sometimes

Q2 DOES SHE HAVE AMBLYOPIA?

Strabismus

- Esotropia is highly amblyogenic (even if intermittent)
- Exotropia is rarely amblyogenic

Esotropia typically = PLUS +/- STEEP AC/A RATIO

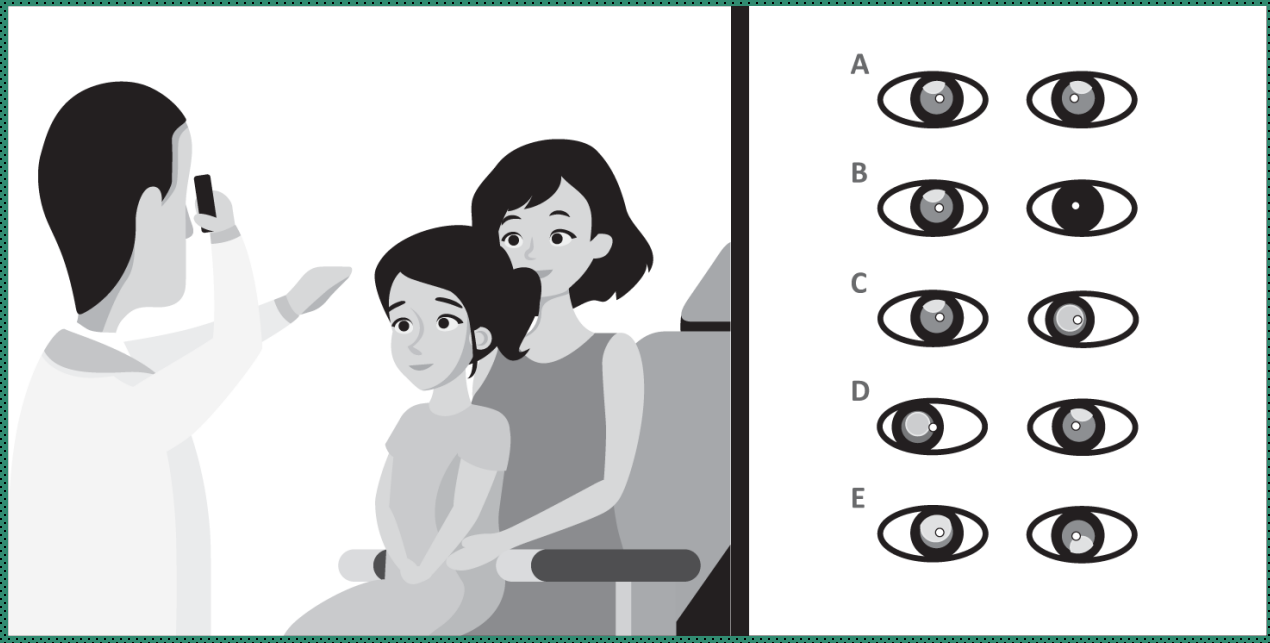


Q2 DOES SHE HAVE AMBLYOPIA?

Anisometropia

- Typically not picked up until 3-5 yo as no one checks vision until now (and child looks normal)

- These ones are a surprise to everyone (unless there is a family history)

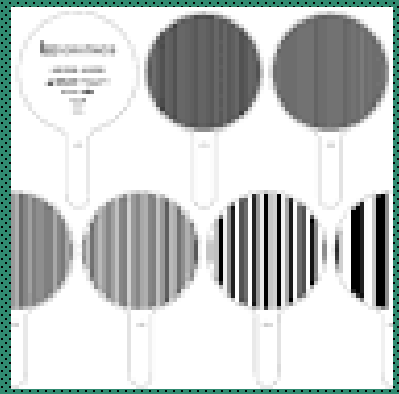


PROBLEM: HARD TO BE SURE ON VISION IN THIS AGE GROUP

Tests you can try

- Beware the 2nd eye phenomenon)

Preferential looking? (Cardiff, Lea paddles)



Child-friendly well-normed tests

- L:ea (3m)
- Kay

If no luck, fixation preference, fix and follow, aversion to cover

REFRACTION

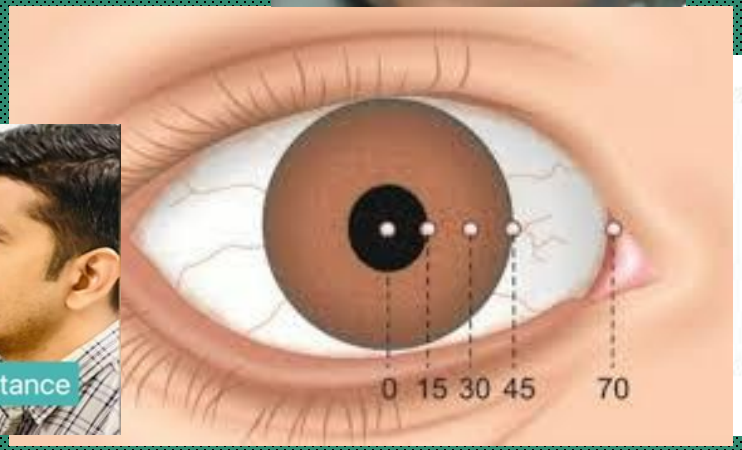
Distance ret: +2.00DS OU

Cyloplegia: +3.75DS OU

MOTOR EXAM

- Cover test (look carefully)
  - (Hirshberg)
- Motilities

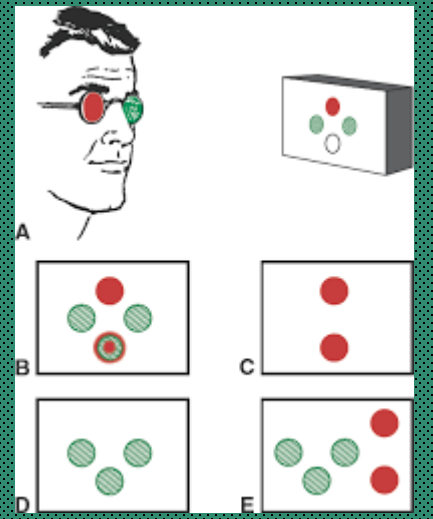
  (NPC if exo)



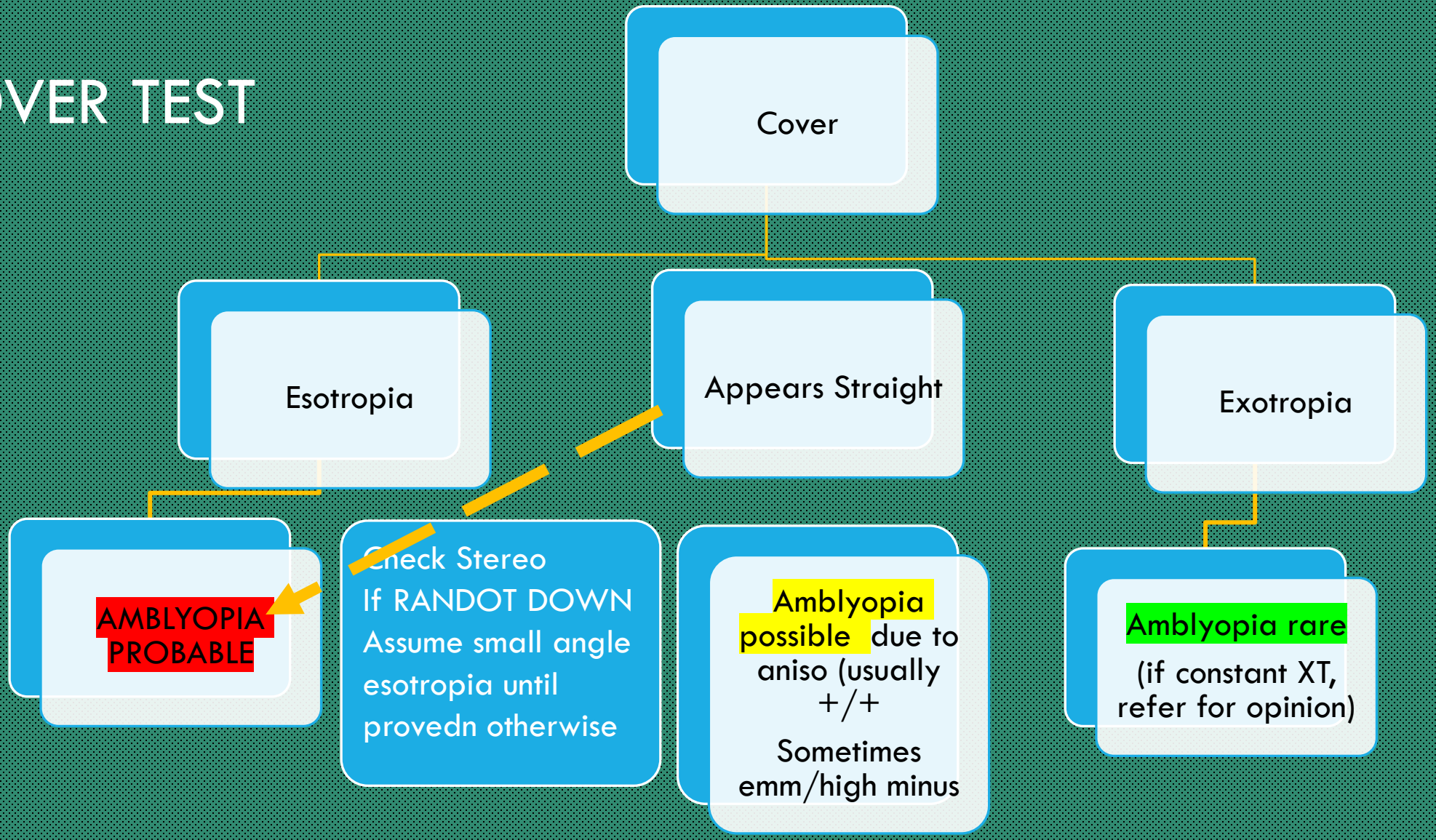
SENSORY EXAM

- Stereo?
- W4D

(children who are 4 can count to 4)



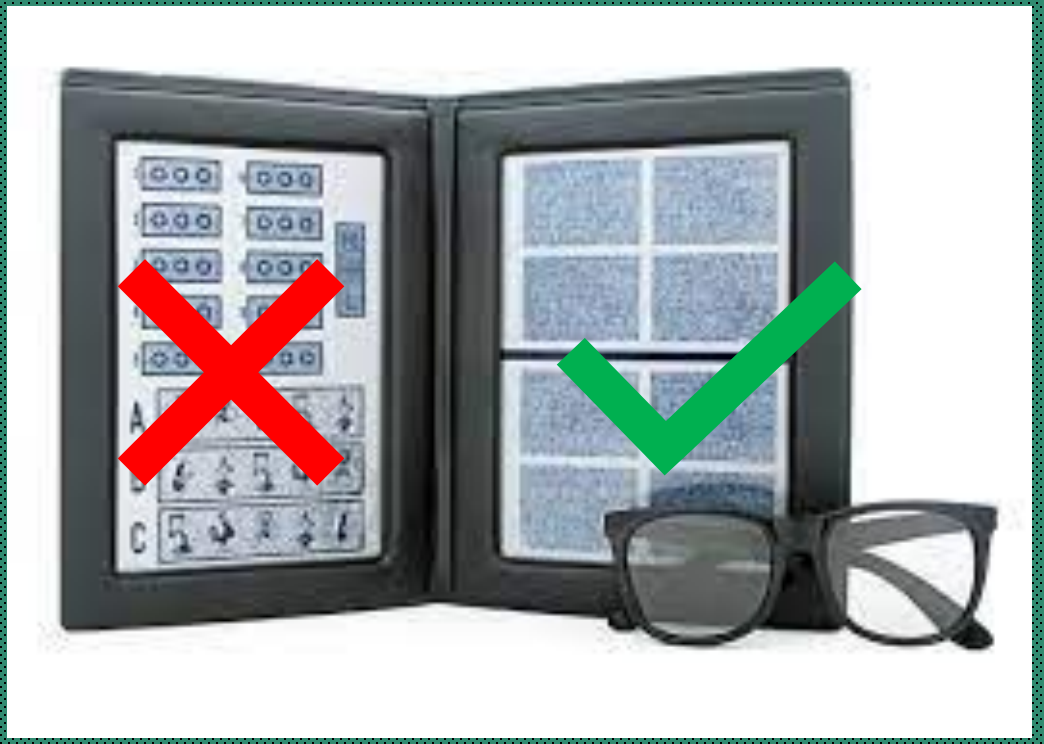
COVER TEST


Cover
Esotropia
Appears Straight
Exotropia
AMBLYOPIA PROBABLE
Check Stereo
If RANDOT DOWN
Assume small angle esotropia until provedn otherwise
Amblyopia possible due to aniso (usually +/+
Sometimes emm/high minus
Amblyopia rare
(if constant XT, refer for opinion)

SENSORY TESTS

- Randot vs circles (what is normal for age)
- Base in prism and watch for movement (don't need to tell you if two)

- Mirror pola?

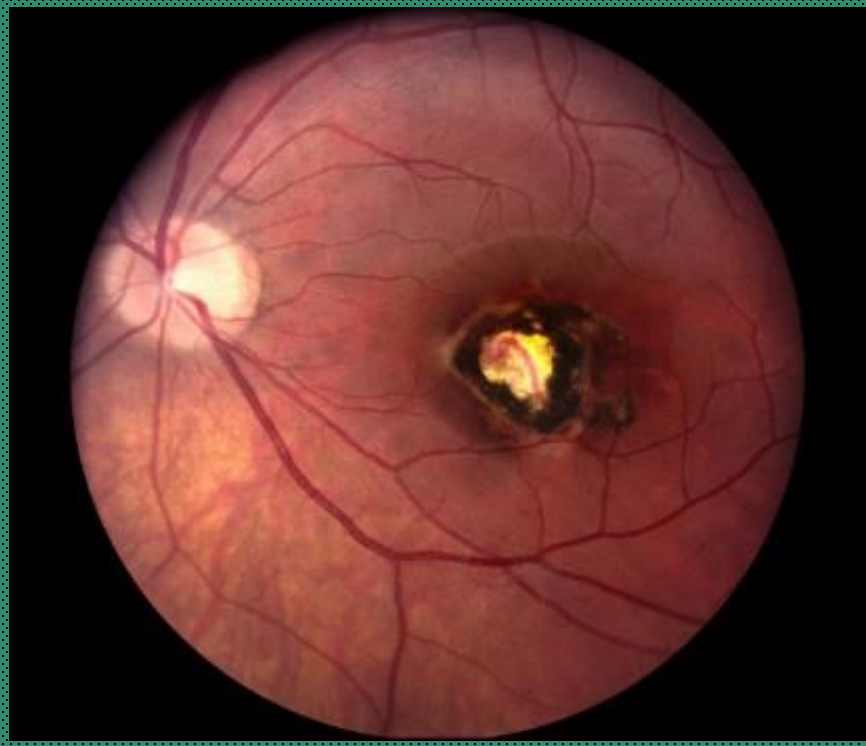


EYE HEALTH: RULE OUT OTHER CAUSES OF VISION LOSS

- Toxoplasmosis

- Or … retinoblastoma

  Risky age is 18months -3 years (just the age you are likely to have poor compliance with testing and difficulty checking vision)



YOU MUST SEE THE RETINA OF EVERY CHILD WITH REDUCED VISION AND/OR STRABISMUS

ANNE B - FINDINGS

PC: Intermittent esotropia – usually when eating/tired

- You don't see it, Mum doesn't see it

CT D esophoria, near esophoria, slow recovery

- BREAKS FUSION WITH 6 BI

Vision: Able to get 3/6 with Kay pics binocularly.

- Not keen on cover of LE

Stereo: All 3 animals. Randot shapes: NO

Dry ret +1.50

- Cyclo +3.50 OU

Health: Fundus examination and lenses- normal

RISK ANALYSIS: HOW MUCH PLUS IS SIGNIFICANT?

- Is the child's prescription within the normal range for age?
- Does this abnormal amount increase the child's risk of amblyopia/strabismus? (LEAT/Atkinson)

- Does treating for this abnormal amount
- 1) prevent amblyopia/strabismus
  2) interfere with the "normal" emmetropisation process

HOW MUCH PLUS IS SIGNIFICANT?

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- Does this abnormal amount increase the child's risk of amblyopia/strabismus? (LEAT/Atkinson)

- Does treating for this abnormal amount
- 1) prevent amblyopia/strabismus YES – REDUCES RISK
  2) interfere with the "normal" emmetropisation process NO

PLAY THE ODDS

- If >+3.50 cycloplegia in infancy have risk of developing
- Strabismus (14x)
- Amblyopia (6x)
- ~5% of children have hyperopia >+3.5

- Prescribing for these children reduced these risks:
- Strabismus 14→4
- Amblyopia 6→2.5

PRESCRIBING FOR PLUS REDUCED THE RISK OF STRABISMUS AT AGE 4

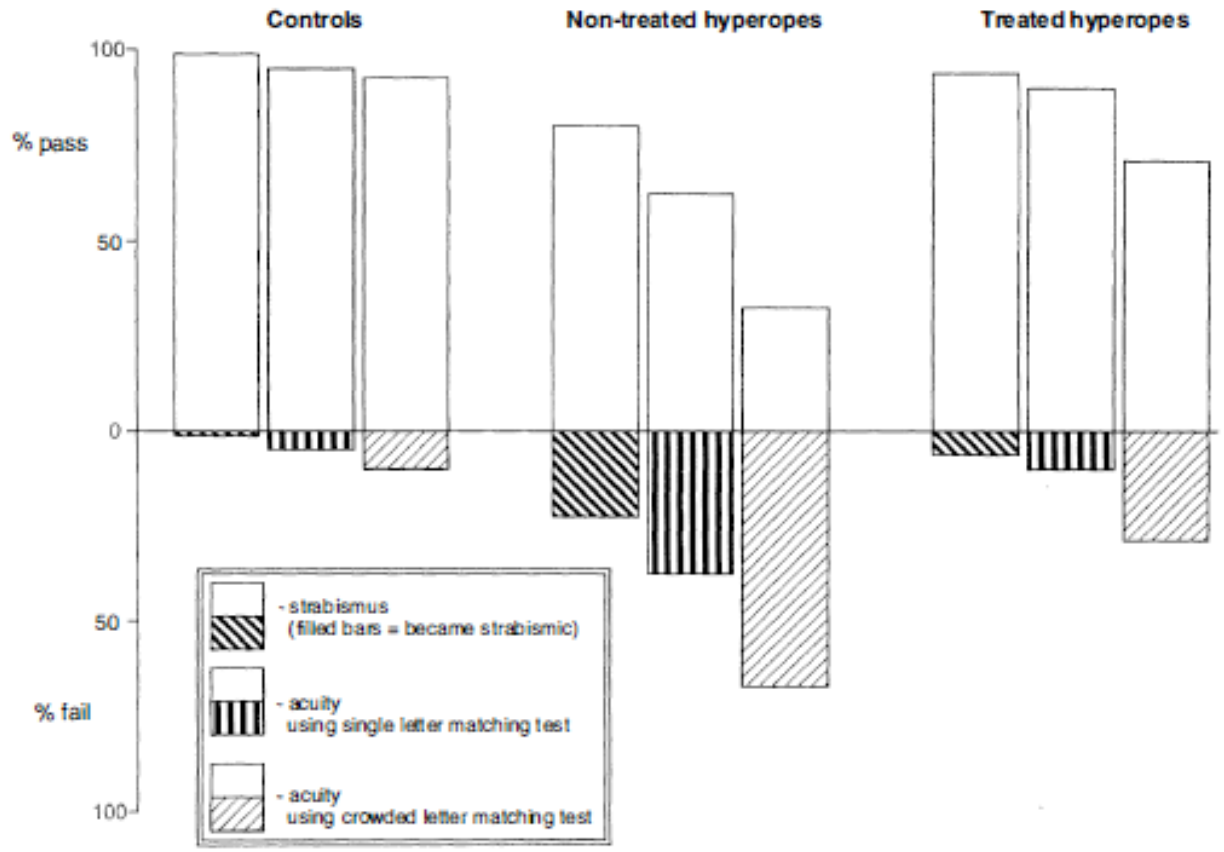
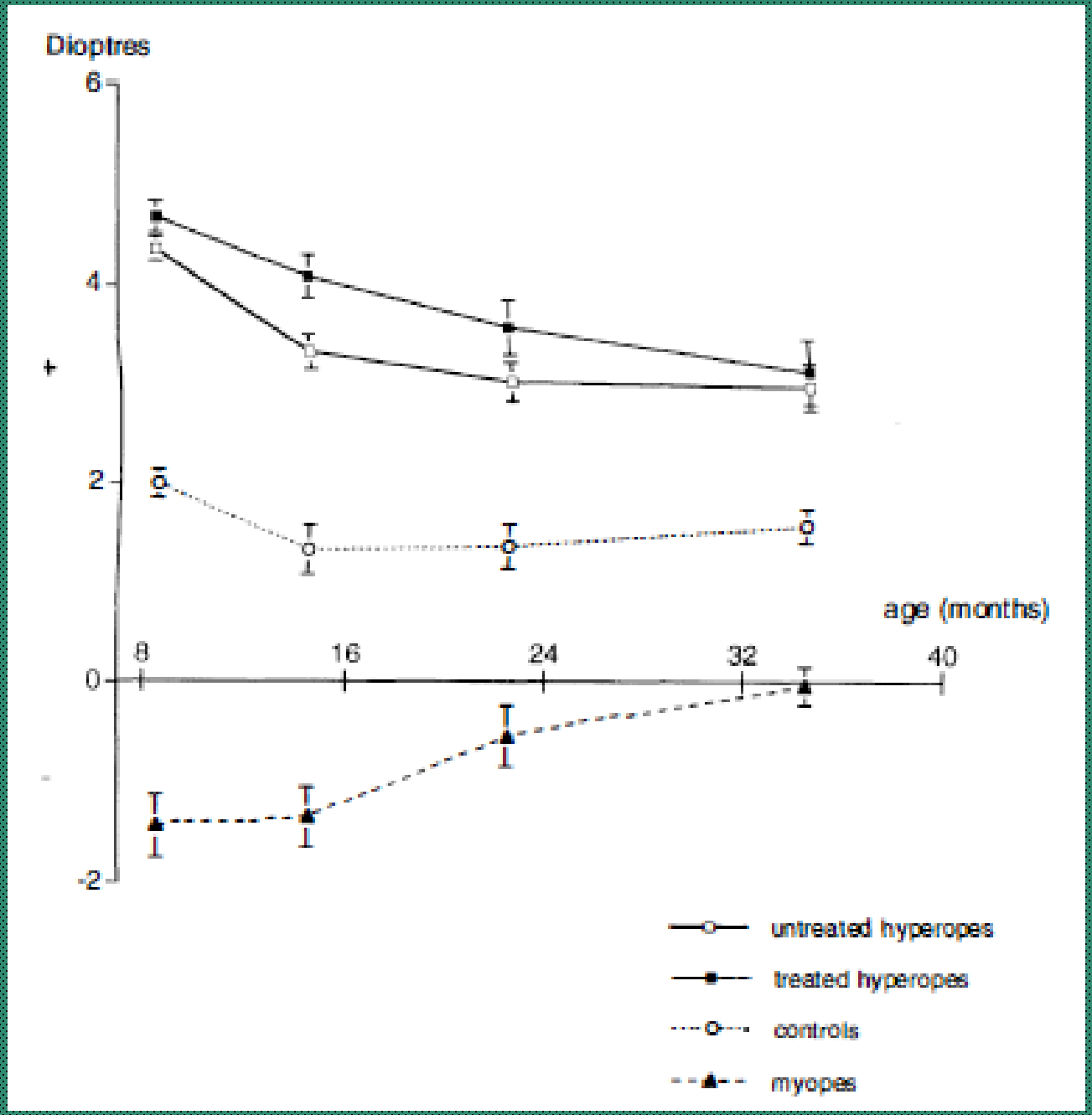


Fig. 3. *Outcome measures at 4 years from the first screening programme: strabismus; acuity measured using single letters; acuity measured using the Cambridge Crowding Cards (see text for 'failure' criteria).*

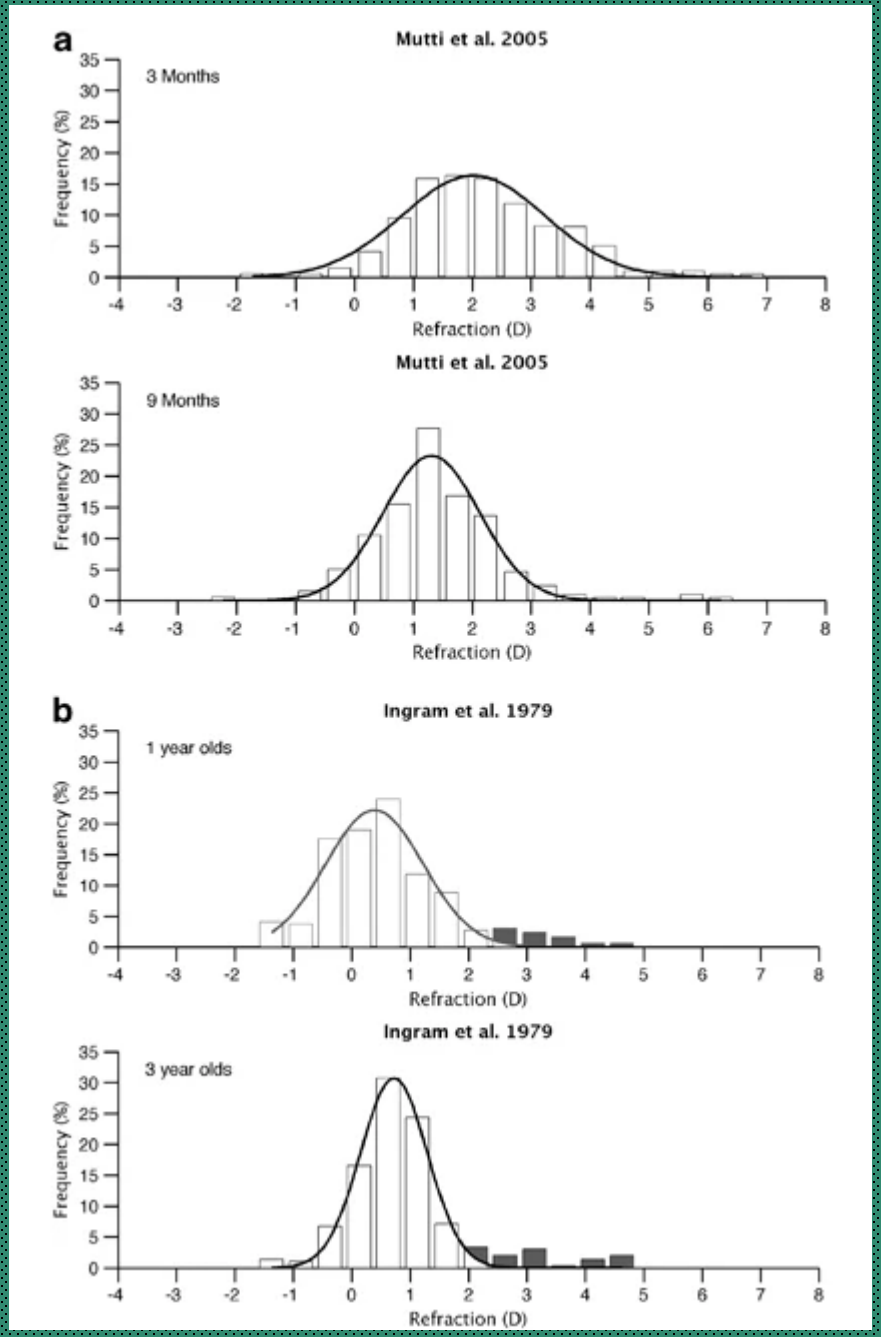
Atkinson Eye (1996) 10, 189-198

You will miss about half the amblyopes if you don't use a crowded target

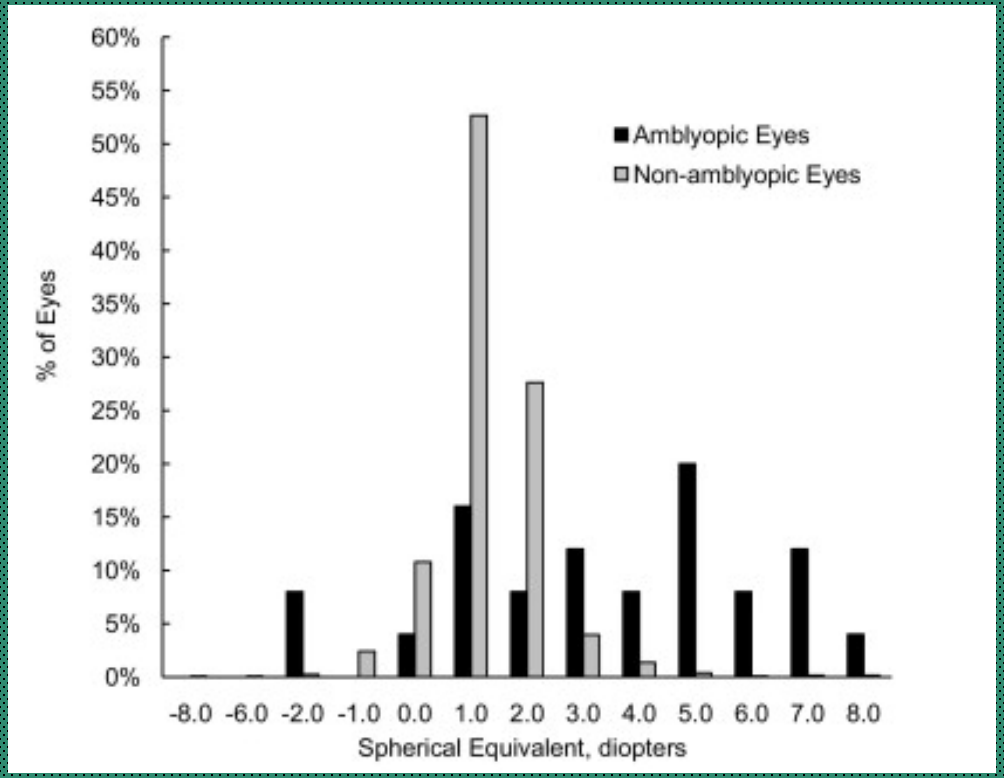
MOST EMMETROPISATION IN CHILDREN HAS OCCURRED BY AGE 3



AND HIGH HYPEROPES (3+) MAY NOT EMMETROPIZE NORMALLY ANYWAY



Flitcroft: Eye (2014) 28, 169–179



Pai Ophthalmology (2012) 119(1):138-144

CYCLOPLEGIA

"Many studies on children have shown that lack of cycloplegia is associated with slight overestimation of myopia and marked errors in estimates of the prevalence of emmetropia and hyperopia."

(Morgan 2015: **https://doi.org/10.1111/aos.12642**)

Poor correlation between distance ret and cycloplegic ret in this age group, and amount of variation within individuals hard to predict

MANAGEMENT

- Sure one eye is esotropic some of the time (unsure which eye)
- Unsure whether amblyopia present or not
- Sure that hyperopia, age and intermittent esotropia make it highly likely she WILL develop amblyopia (if she doesn't have it already).

→ Prescribe rx (full cyclo) for full time wear

Rev 4-6 weeks.

- Continue measuring vision and checking stereopsis **until you are sure she has equal vision and random dot stereopsis. If get consistently reduced vision in one eye after 3 months start additional treatment**
- Check for more plus at every visit (dry ret/ MEM – no need to cyclo again unless not winning)

LEO

October

Childcare has noticed RE turning in

Doing well although not very keen on drawing

Mum had got an opinion on eye turn around age 1 but told just epicanthus

Otherwise healthy

No FOH of strabismus

FINDINGS

Cover test D R esotropia 15PD N 25PD RET (constant)

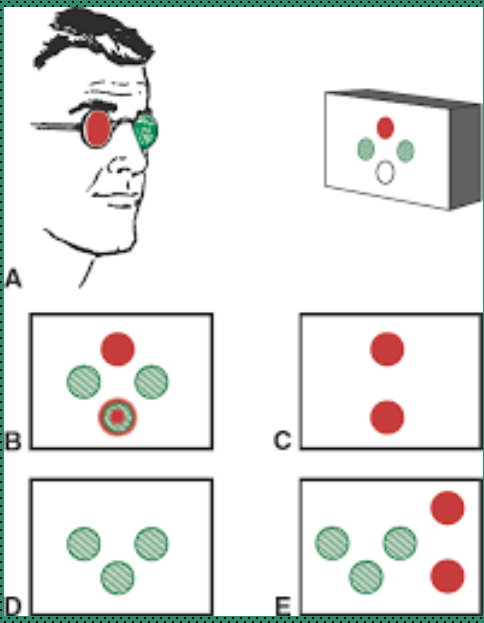
Vision Lea R 3/30 L 3/3.8

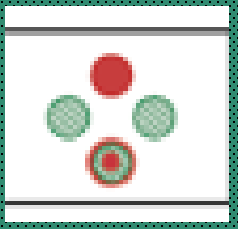
Ret R +4.50DS L +1.50DS

Cyclo R+5.50DS L+3.50DS

Stereo No fly W4D – 3 dots

Eye health Normal





LEO – QUESTIONS?

- What therapy should we start with? (glasses, patching, atropine?)
- When should we add another one?
- When do we stop treatment?
- What is his risk of regressing?
- How do we aid compliance?

PEDIG – START WITH GLASSES

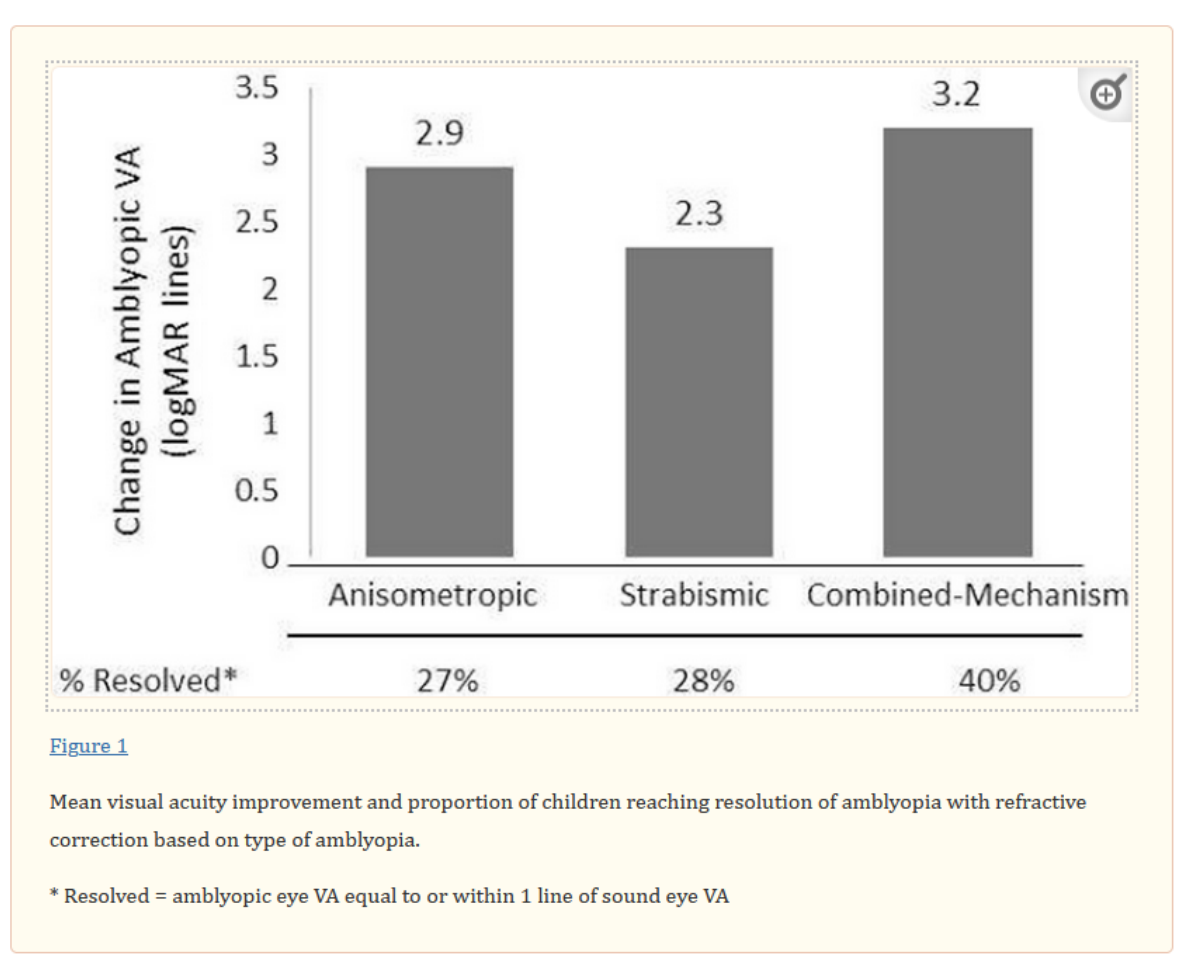


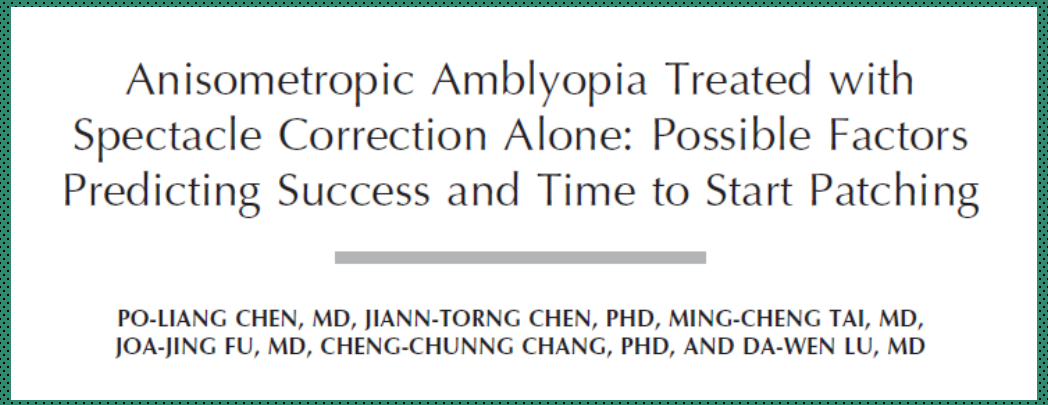
Figure 1

Mean visual acuity improvement and proportion of children reaching resolution of amblyopia with refractive correction based on type of amblyopia.

* Resolved = amblyopic eye VA equal to or within 1 line of sound eye VA

- Good improvements to acuity with glasses alone
- Helps with compliance (better vision to start with if requires patching)
- Cures 25% (even if strabismic)

WHEN TO ADD AN ADDITIONAL TREATMENT?



Anisometropic Amblyopia Treated with Spectacle Correction Alone: Possible Factors Predicting Success and Time to Start Patching

PO-LIANG CHEN, MD, JIANN-TORNG CHEN, PHD, MING-CHENG TAI, MD, JOA-JING FU, MD, CHENG-CHUNNG CHANG, PHD, AND DA-WEN LU, MD

"The time to resolution of amblyopia varied (ranging from four to 40 weeks), but no patients showed an improvement in VA of more than 0.1 logMAR over four consecutive visits."

- Can continue glasses alone until vision plateaus with no improvement over 2 visits
- Or if you are running out of time (e.g. about to start school) – you may choose to start sooner with additional treatment as it is harder once they start school

PATCHING OR ATROPINE?

PEDIG found similar results after 6 months (regardless of if strabismic or amblyopic)

- Patch gets there quicker – both get there eventually.

- I usually start with patching as compliance is usually best at the beginning of treatment.
- Atropine is “easier” and a good go-to if you are losing compliance with patching (but harder to go from atropine to patching)

SO I ONLY NEED TO PATCH FOR 6 MONTHS?

- Yes… and no

- PEDIG protocol gets you to 6/9 in 6 months.
- It does not get you to 6/6
- Other studies show much higher percentages of patients reaching 6/6 with increased dosages of patching and longer time frames
- If plateaued, consider increase dose to check whether further improvement possible

"The magnitude of VA improvement found at the mostly 4- to 6-month primary outcome examinations is not the maximum benefit expected to be achieved for all participants, but instead the maximum length of time that the prescribed treatment regimens could be maintained before investigators would insist on a change of treatment in cases of poor outcome; in many cases, VA can improve further with continued treatment."
Chen 2016 The Amblyopia Treatment Studies: implications for clinical practice.
doi:10.1016/j.yaoo.2016.03.007.

AND 2 HOURS IS ENOUGH, RIGHT?

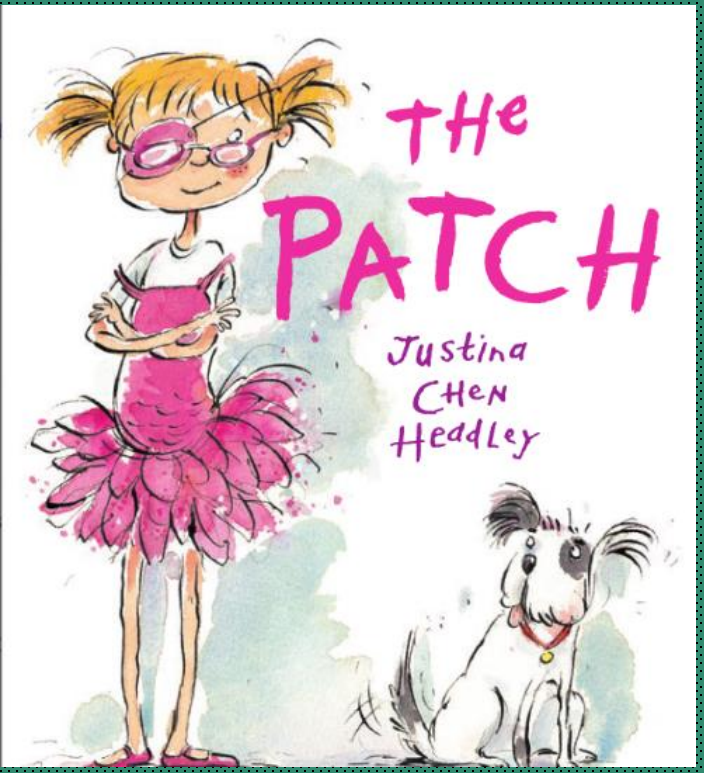
BMJ. 2007 Oct 6; 335(7622): 707.
Published online 2007 Sep 13. doi: 10.1136/bmj.39301.460150.55
PMCID: PMC2001048
PMID: 17855283

Objectively monitored patching regimens for treatment of amblyopia: randomised trial

Catherine E Stewart, department of health research fellow,[1] David A Stephens, professor of statistics,[2] Alistair R Fielder, professor of ophthalmology,[1] and Merrick J Moseley, senior lecturer[1], ROTAS Cooperative

"The visual outcome was similar for those children who received three to six hours a day or more than six to 12 hours a day, but significantly better than that in children who received less than three hours a day. Children aged under 4 required significantly less occlusion than older children. Visual outcome was not influenced by type of amblyopia." (Stewart 2007)

PATCHING: THE FIRST 100 HOURS ARE THE WORST



- Compliance is key
- Activity less critical – if you can get them doing near work that's great – if not, still better that they are patching than not patching.
- Avoid dangerous play!
- Consider ways to normalise the experience, add fun and provide choice

COMPLIANCE

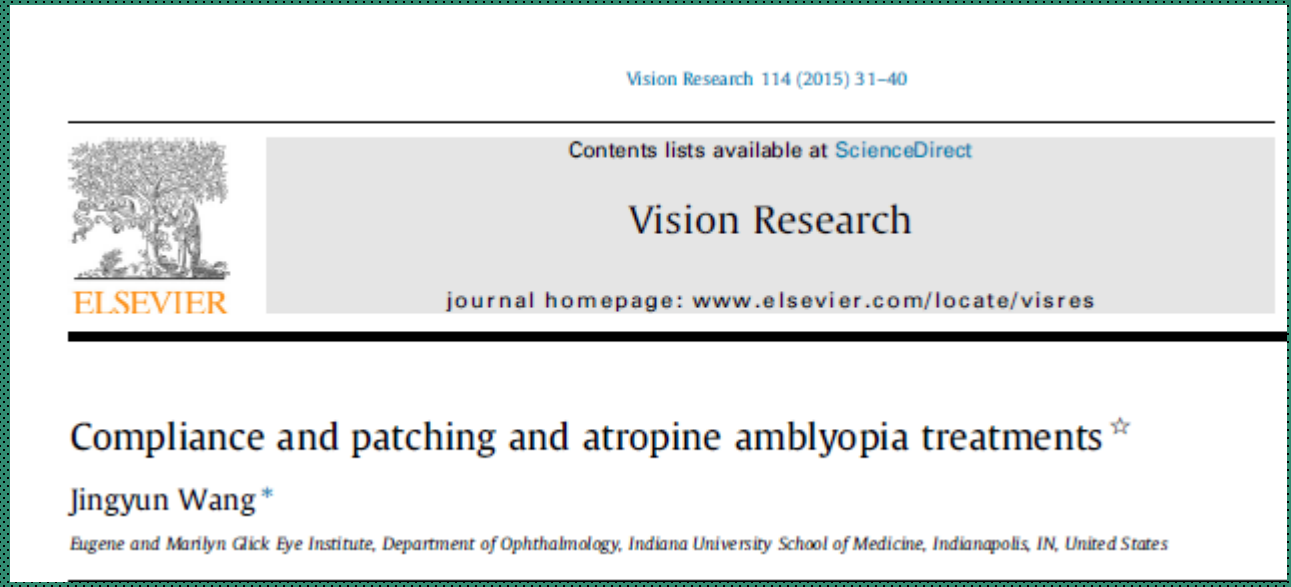
Best compliance is in the first 3 months.

Patients are motivated when the vision is clearly improving at each visit

Get your hours in early before compliance wears off.

Worse compliance with a range of social factors – parental understanding of the problem (and your ability to navigate the solution) is key.

Use stickers/reward charts etc – bribery is good.



Vision Research 114 (2015) 31–40

Contents lists available at ScienceDirect

Vision Research

journal homepage: www.elsevier.com/locate/visres

Compliance and patching and atropine amblyopia treatments ☆

Jingyun Wang *

Eugene and Marilyn Glick Eye Institute, Department of Ophthalmology, Indiana University School of Medicine, Indianapolis, IN, United States

"..In addition to generally low compliance with patching, compliance follows a dynamic pattern, as it usually decreases over time. Not surprisingly, in 3- to 8-year-old children, compliance is lower when longer treatments are required. The, the mean compliance decreased from 60% at the beginning to 40% by the 50th day, and to 30% by the 100th day . Similar significant decreasing patterns of compliance over time were found in older children (7–16 years old) too"

Wang 2015

IS PATCHING REALLY THAT BAD?

- "Amblyopic children reported that patching and atropine treatments did not have a significant impact on their quality of life. Patching and atropine should continue to be offered as first-line treatments for amblyopia, as children appear to tolerate both well and do not favor one over the other."

STRABISMUS
2019, VOL. 27, NO. 3, 156–164
https://doi.org/10.1080/09273972.2019.1643894

Taylor & Francis
Taylor & Francis Group

Check for updates

Amblyopia treatment and quality of life: the child's perspective on atropine versus patching

Deborah A Steel, MMedSci, BMedSci[a,b], Charlotte J Codina, PhD, PG Cert FHEA, BMedSci[a], and Gemma E Arblaster, MSc, BMedSci[a]

[a]Orthoptics, Bradford Royal Infirmary, Bradford; [b]Academic Unit of Ophthalmology and Orthoptics, University of Sheffield, Sheffield

ABSTRACT

Background: The impact on children of patching versus atropine treatment for amblyopia was assessed using children's perspective Health-Related Quality of Life (HRQoL) scores in 5 to 7-year olds.

Methods: Forty-six children on the threshold of commencing either patching or atropine treatment for amblyopia were recruited. Treatment was prescribed for uniocular amblyopia of visual acuity (VA) 0.2 logMAR or worse. After four weeks of their chosen treatment, each child completed the Child Amblyopia Treatment Quality-of-Life Questionnaire (CAT-QoL). The Pediatric Quality of Life Inventory (PedsQL™), Young Child (5–7) Self-Report version, was completed before and after

KEYWORDS
Amblyopia; Quality of Life; CAT-QoL

WHAT ABOUT ATROPINE?

- Atropine 1.0% - readily available with rx, cost ~$25/bottle
- Start twice/weekly

Consider impact on schooling: Making the good eye blurry

- These kids are usually in the age group where they are learning to read
- If reading is suffering, at least ensure wearing appropriate rx in good eye and not plano

WHAT OTHER OPTIONS ARE THERE?

- Recent paper by Jost looked at dichoptic movies (~5hrs/ week)
- Similar results to patching
- Possibly better improvements in stereo
- Hard to engage children of this age with “games” (and VR headsets too heavy for little heads)
- No commercially available options (yet)

Li J AAPOS 2015;19:401-405)

GOALS TIMEFRAMES AND EXPECTED OUTCOMES

- If you can get the child straight in the glasses, need to do patching/atropine until vision is equal (or as close as you can get it: ideally 6/9 or better)
- If you cannot get the child straight in glasses, they are at CONTINUED risk of amblyopia and will may need to do maintenance penalisation until outside
- You need to watch them carefully until at least 10-11 as regression occurs in 25%
- This is especially true if they get slack with glasses wear and they return to intermittent esotropia

CAN'T HE JUST HAVE SURGERY?

- A 3 part problem: 1) Hyperopia→ 2) esotropia→ 3)amblyopia

- Surgery fixes part 2. It does not fix part 1, and may not fix part 3.
- Goal of surgery is to provide "cosmetically normal" appearance (strabismus <10pd in either direction). You may get straight and RDS and this is great – but is not assumed nor promised.

WHAT GLASSES DO AND DON'T DO

- Hyperopia→ esotropia→ amblyopia
  - Hyperopia + high AC/A ratio drives strabismus
  - Always fully correct the STRAIGHT eye – this is the one causing the turn
- Aim of glasses is to make surgery unnecessary
- Aim of glasses is NOT "so the child grows out of it and doesn't need them in the future"

WHAT PATCHING DOES AND DOESN'T DO

- Patching does not fix the hyperopia
- Patching does not fix the strabismus
- Patching does redirect the brain's attention to the eye which has had little practice, to encourage it to rearrange the neural real estate

  → this is all it does.

WHEN IS IT SAFE TO STOP PATCHING?

- If vision plateaus, try a boost of increased treatment (e.g. increase to 6 hours of patching on weekends)
- If still no improvement, taper patching and stop
- Monitor carefully at 3months then every 6 months until at least age 10
- If the esotropia persists you may need to do maintenance patching as eye may regress if constantly strabismic

MANAGEMENT

- Prescribe full cyclo rx for full time wear (R+5.50DS L+3.50DS) and review every 4-6 weeks
- Add patching a little earlier to make the most of the remaining couple of months before school
- Can use Bangerter foil instead of patch at school but compliance similar to patching. Additional plus at distance in the good (left eye) is well tolerated, helps with alignment and does not disadvantage reading.
- Ideally you want to add plus until they are definitely straight and give you Random Dot stereo or they complain about blur in the distance despite FT wear for >1 week*

AMBLYOPIA RECURRENCE

- Occurs in 25%
- Most common in first few months after stopping treatment but can be months later
- Reduced by tapering treatment (e.g. 6 hours patching to two)
- Anisometropia >1.5 increases risk of regression
- Any residual esotropia is still amblyogenic until end of sensitive period
    - even if small
    - Always check for random dot stereo
- Less common if older when discontinuing treatment

PIA (10)

- Had glasses in early primary school but didn't wear much as "vision was fine"
- Hasn't had eye test for 3 years
- Patching was suggested initially – tried for a few weeks then gave up as too hard to coordinate around school and after school activities
- Recently moved from Melbourne and had a health assessment at the new school – referred as vision poor in left eye (R 6/6 L 6/24)

FINDINGS

- R 6/6 L 6/24
- Stereo all animals, 60” W/C, RDS shapes present
- Ret R +0.50DS L+3.50/-1.00x180
- MEM over this: R +0.25DS L +1.00DS
- Subjective: R plano 6/3.8 L +3.50/-0.75x180 6/15
- Phoria D 0 N 2 exo; intermittent suppression
- Cyloplegia: R +1.00DS L +4.00/-1.25x180
- Fundus examination = healthy disc and macula and periphery normal

PIA – QUESTIONS?

- When is too old to start treatment?
- If she has had treatment, will it still improve if we try?
- Will she tolerate maximum plus now she is older?
- Compliance has been an issue in the past – how do we improve our chances of success this time?

TOO OLD TO START TREATMENT?

Patching vs Atropine to Treat Amblyopia in Children Aged 7 to 12 Years: A Randomized Trial

Pediatric Eye Disease Investigator Group*

* The writing committee and a list of the members of the Pediatric Eye Disease Investigator Group (PEDIG) participating in the study appear in the acknowledgements.

Abstract

Objective—To compare patching with atropine eye drops in the treatment of moderate amblyopia (20/40 -20/100) in children age 7 to 12 years.

"Conclusions—Treatment with atropine or patching leads to similar degrees of improvement in 7 to 12 year old children with moderate amblyopia. About 1 in 5 achieves 20/25 or better visual acuity in the amblyopic eye."

NO

SENSITIVE/PLASTIC/CRITICAL PERIOD

- Historically believed that you had until 8 to correct "the problem" (acuity) – known as the critical period (Hubel and Wiesel and the dominance columns of cats) 1963
- "Critical period" depends on the layer you look at and the function you test
- Now better understanding that at least some of the deficits in amblyopia are due to higher order visual processing (not just in the dominance columns of V1) and these are modifiable for much longer
- Ability to be more or less plastic controlled by neurotransmitters ("molecular brakes") - perhaps an area for future intervention?

- However, if new problem arises (e.g. develop cataract due to steroid use), would be unlikely to develop amblyopia after this time (8ish - sensitive period)

Daw Arch Ophthalmol. 1998;116(4):502-505. doi:10.1001/archopht.116.4.502

8 IS NOT THE CUT-OFF

- Worth a try even into adolescence (some studies show good improvements even until age 17, case reports of improvements in adulthood)

- Less effective if already treated

- Poor compliance with treatment does not count as being already treated, but you do need to uncover why compliance was poor and address this to get good outcomes

GOALS

- Improve vision to 6/12 so better working spare
- Improve near function

Be clear on what your goals are and discuss with child and parent until you agree on what the outcomes are for treatment.

This is not a cosmetic problem but a functional one – they need to know that if they do nothing now, they are stuck with this bad eye for life.

WHAT TO PRESCRIBE?

- Older children generally less accepting of full plus
- Can push plus at near in a multifocal if need be to improve alignment
- I usually prescribe maximum plus they will tolerate in the "good eye" and the subjective in the "bad eye"
  - here: R+1.00 6/12 +0.75 6/7.5, +0.50 6/6++, +0.25 6/4.8 plano 6/3.8 => +0.50
- Consider contact lenses to reduce aniseikonic effects (and improve compliance if spec wear an issue in the past)

PROCESS

- Start with prescription FULL TIME WEAR (CL's if possible if significant aniso)
- If still minimal improvement, add patching.
  - Note more patching and better compliance required when older – and hours outside of school become limited
- Consider atropine (impact on schooling), over plus in good eye if tolerated (part time refractive penalization – looks normal, easy in CL's, near ok)
- Consider binocular therapies

BINOCULAR THERAPIES: EARLY PROMISE IN PILOTS AND SMALL STUDIES

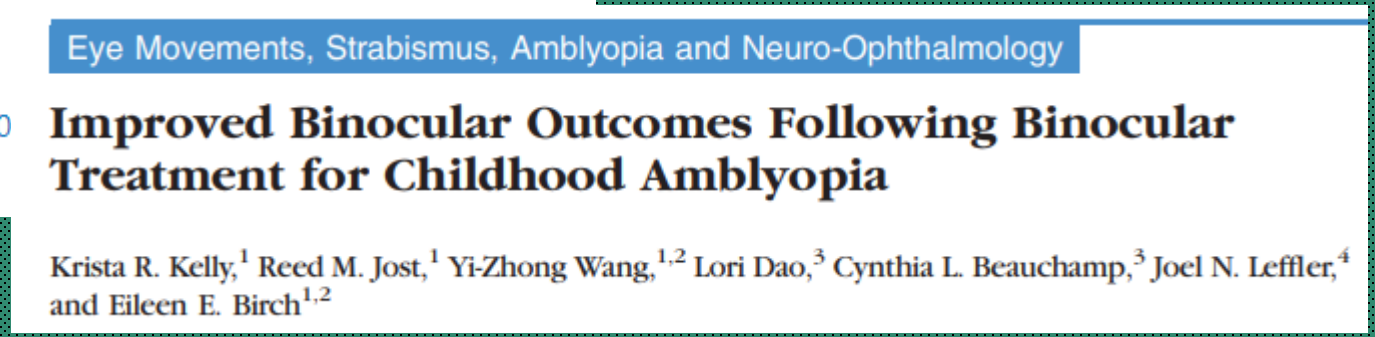
Review > Strabismus. 2011 Sep;19(3):110-8. doi: 10.3109/09273972.2011.600418.

Restoration of binocular vision in amblyopia

R F Hess [1], B Mansouri, B Thompson

Affiliations + expand

PMID: 21870914 DOI: 10.3109/09273972.2011.60



Eye Movements, Strabismus, Amblyopia and Neuro-Ophthalmology

Improved Binocular Outcomes Following Binocular Treatment for Childhood Amblyopia

Krista R. Kelly,[1] Reed M. Jost,[1] Yi-Zhong Wang,[1,2] Lori Dao,[3] Cynthia L. Beauchamp,[3] Joel N. Leffler,[4] and Eileen E. Birch[1,2]

Kelly et al (2018): "CONCLUSIONS. After 2 weeks, binocular treatment in amblyopic children improved visual acuity and binocular outcomes, reducing the extent and depth of suppression and improving stereoacuity. Binocular treatments that rebalance contrast to overcome suppression are a promising additional option for treating amblyopia.

UNFORTUNATELY, LESS CONVINCING IN THE REAL WORLD

Roda M, Pellegrini M, Di Geronimo N, Vagge A, Fresina M, Schiavi C (2021) Binocular treatment for amblyopia: A meta-analysis of randomized clinical trials. PLoS ONE 16(10): e0257999. https://doi.org/10.1371/journal. pone.0257999

Conclusions

This meta-analysis found no convincing evidence supporting the efficacy of binocular treatment as an alternative to conventional patching. Therefore, the binocular treatment cannot fully replace traditional treatment but, to date, it can be considered a valid complementary therapy in peculiar cases. Further studies are required to determine whether more engaging therapies and new treatment protocols are more effective.

A Randomized Trial of Binocular Dig Rush Game Treatment for Amblyopia in Children Aged 7 to 12 Years

*Pediatric Eye Disease Investigator Group**
Writing Committee: Jonathan M. Holmes, BM, BCh,[1] Ruth E. Manny, OD, PhD,[2] Elizabeth L. Lazar, MS, MPH,[3] Eileen E. Birch, PhD,[4] Krista R. Kelly, PhD,[4] Allison I. Summers, OD, MCR,[5] Stacy R. Martinson, OD,[6] Aparna Raghuram, OD, PhD,[7] Jeffrey D. Colburn, MD,[8] Christine Law, MD,[9] Justin D. Marsh, MD,[10] Derek P. Bitner, MD,[11] Raymond T. Kraker, MSPH,[3] David K. Wallace, MD, MPH[12]

Purpose: To compare visual acuity (VA) improvement in children aged 7 to 12 years with amblyopia treated with a binocular iPad game plus continued spectacle correction vs. continued spectacle correction alone.
Design: Multicenter randomized clinical trial.
Participants: One hundred thirty-eight participants aged 7 to 12 years with amblyopia (33–72 letters, i.e., approximately 20/200 to 20/40) resulting from strabismus, anisometropia, or both. Participants were required to have at least 16 weeks of optical treatment in spectacles if needed or demonstrate no improvement in amblyopic-eye visual acuity (VA) for at least 8 weeks prior to enrollment.
Methods: Eligible participants (mean age 9.6 years, mean baseline VA of 59.6 letters, history of prior amblyopia treatment other than spectacles in 96%) were randomly assigned to treatment for 8 weeks with the dichoptic binocular Dig Rush iPad game (prescribed for 1 hour per day 5 days per week) plus spectacle wear if needed (n = 69) or continued spectacle correction alone if needed (n = 69).
Main Outcome Measures: Change in amblyopic-eye VA from baseline to 4 weeks, assessed by a masked examiner.
Results: At 4 weeks, mean amblyopic-eye VA letter score improved from baseline by 1.3 (2-sided 95% confidence interval [CI]: 0.1–2.6; 0.026 logMAR) with binocular treatment and by 1.7 (2-sided 95% CI: 0.4–3.0; 0.034 logMAR) with continued spectacle correction alone. After adjusment for baseline VA, the letter score difference between groups (binocular minus control) was -0.3 (95% CI: -2.2 to 1.5, *P* = 0.71, difference of -0.006 logMAR). No difference in letter scores was observed between groups when the analysis was repeated after 8 weeks of treatment (adjusted mean: -0.1, 98.3% CI: -2.4 to 2.1). For the binocular group, adherence data from the ed that slightly more than half of the participants (58% and 56%) completed >75% of prescribed y the 4- and 8-week visits, respectively.
ons: In children aged 7 to 12 years who have received previous treatment for amblyopia spectacles, there was no benefit to VA or stereoacuity from 4 or 8 weeks of treatment with the nocular Dig Rush iPad game. *Ophthalmology 2019;126:456-466 © 2018 by the American Academy nology*

mental material available at www.aaojournal.org.

MANAGEMENT AND REVIEW

Prescribe: R +0.50DS (6/6) L +3.50/-0.75x180 (6/15 patchy)

- SV toric contact lenses Full time wear

Review:

6 weeks later Vision w CL's R 6/4.8 L 6/15++

Future:

- Chase plus at future visits (especially RE)
- Consider overplus RE as penalisation (eg R+1.00DS).
- Consider vision therapy for residual accommodation/spatial issues and/or binocular/dichoptic training

TAKE HOME MESSAGES

- Treat aggressively early – response to treatment faster when younger
- Start with glasses, add patching/atropine when vision improvement plateaus
- Taper treatment and review frequently for recurrence until at least age 10
- Consider impact of treatment as well as the problem
- Never too old to try – but need good compliance to make progress
- Consider binocular treatments in older children, or if unsuccessful with traditional methods

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