


Treating Amblyopia without Patching

6/4/2026

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JR- 4 year old – March 4, 2019 –Routine 404 - Other OD

- Private Practice in Toronto
- First eye exam, no current glasses
- Mom noticing the JR's right eye turning in occasionally

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JR – March 4, 2019 – Routine 404 – Other OD

- Unaided Distance Visual Acuity
 - OD: 20/200 OS: 20/30
- Cover Test
 - Distance/Near: Right Intermittent Esotropia
- Dry Retinoscopy
 - OD: +4.50 OS: +2.50
- Stereopsis
 - 400" (Stereofly)

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JR – March 12, 2019 - Cyclo- Other OD

- Cycloplegic Retinoscopy
 - OD: +6.00 OS: +3.00
- Ocular Health unremarkable
- Final Spectacle Rx:
 - OD: +4.00 OS: +1.00

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JR – April 29, 2019 – Other OD August 21, 2019 – Other OD

- Aided Distance Visual Acuity with new Rx
 - OD: 20/80 OS: 20/30
 - No information on Crowded vs Uncrowded
- No cover test information
- Aided Distance Visual Acuity
 - OD: 20/70 OS: 20/25-2

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Amblyopia Review

- Refractive
 - Anisometropic
 - Meridional
 - Bilateral isoametropic amblyopia
- Strabismic
- Deprivation

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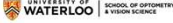


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JR – April 29, 2019 – Other OD August 21, 2019 – Other OD

- Aided Distance Visual Acuity with new Rx
 - OD: 20/80 OS: 20/30
 - No information on Crowded vs Uncrowded
- No cover test information

- Aided Distance Visual Acuity
 - OD: 20/70 OS: 20/25-2
- **Diagnosis:**
 - Anisometric Amblyopia OD

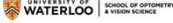
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JR – April 29, 2019 – Other OD August 21, 2019 – Other OD

- Aided Distance Visual Acuity with new Rx
 - OD: 20/80 OS: 20/30
 - No information on Crowded vs Uncrowded
- No cover test information

- Aided Distance Visual Acuity
 - OD: 20/70 OS: 20/25-2
- **Diagnosis:**
 - Anisometric Amblyopia OD
- **Plan?**

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Amblyopia Methods of Treatment

- Wearing/updating refractive correction

Traditional Monocular Treatments:

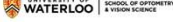
- Occlusion Patching
- Penalization with Atropine

Alternative Monocular Treatment:

- Bangerter Foil

Exercises/Therapy

- Monocular Perceptual Learning
- Dichoptic Therapy
- Vision Therapy

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Wearing Refractive Correction

- The standard primary treatment
 - Give full anisometric prescription (depending on age)
 - Monitor visual acuity over time until improvement plateaus
 - Consider alternative treatment simultaneously or after plateau
 - Is there a remaining constant unilateral strabismus?
 - Can this be addressed with adjustments to prescription Adds?
 - What is initial best-corrected VA? How much do we expect the VA to improve without alternative intervention?

Seete AL, Braafeld YS, Kushner BJ, France TD, Struck MC, Gargano RE. Successful Treatment of Anisometric Amblyopia with Spectacles Alone. *J Am Assoc Pediatr Ophthalmol Strabismus*. 2006;10(1):37-43. doi:10.1016/j.jaapos.2005.08.003

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Occlusion Patching

- Traditional, gold standard for treating unilateral amblyopia
 - Effective, backed by high-quality evidence
 - 6 hours of patching/day can be as effective as full-time patching for severe amblyopia (<20/100)
 - 2 hours of patching/day can be as effective as 6 hours for moderate amblyopia (20/40 - 20/100)
 - At least one hour of near-visual activities

Rajka MM, Beck RW, Holmes J, et al. PEDIG: A Randomized Trial of Patching Regimens for treatment of moderate amblyopia in children. *Archives of Ophthalmology*. 2003;121(5):603-611.

Holmes JM, Kraker RT, Beck RW, et al. A randomized trial of prescribed patching regimens for treatment of severe amblyopia in children. *Ophthalmology*. 2003;110(1):2075-2087.

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Occlusion Patching

- Limitations?
- 25% regression with patching
 - Tends to be considered ineffective after 10 years of age
 - Low adherence rates
 - 48% adherence rate for full prescribed amount of patching
 - Uncomfortable for patient depending on severity of vision reduction
 - Parents feel patching is punitive
 - Social impacts due to cosmesis (if patching outside of home)

Thompson, B., Concetta Morrone, M., Bex, P., Lozama, A., & Sabel, B. A. (2024). Harnessing brain plasticity to improve binocular vision in amblyopia: An evidence-based update. *European Journal of Ophthalmology*, 34(4), 901-912.

Stewart CE, Hossainy HJ, Stephens DA, Fielder AR. Treatment dose-response in amblyopia therapy: the Monitored Occlusion Treatment of Amblyopia Study (MOTAS). *Invest Ophthalmol Vis Sci*. 2004;45(9):3048-3054.

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Penalization with Atropine

- Atropine 1% used 2x/week
- Studies included range from 3-12 years old
 - Results still greater in younger than 7 years old
- VA is maintainable
- May be better tolerated for some for patching
- Equivalent results to patching
- Side effects can include light sensitivity, ocular irritation, headaches, blurry vision

Repka MX, Kraker RT, Beck RW, et al. PEDIG. Treatment of severe amblyopia with weakend atropine: Results from 2 randomized clinical trials. *Journal of American Association for Pediatric Ophthalmology and Strabismus*. 2009;13(3):258-263. PEDIG. A randomized trial of atropine regimens for treatment of moderate amblyopia in children. *Ophthalmology*. 2004;111(11):2076-2085.

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Bangerter Foil

- Alternative to traditional full-occlusion patching for refractive/strabismic amblyopia
- Various filter densities that can be placed over the non-amblyopic eye to reduce VA to the same or worse than the amblyopic eye
 - Adjust filter density in subsequent visits if VA improves or reaches plateau in amblyopic eye.
 - In PEDIG study, done with moderate amblyopia (20/80 or better)
 - Compared 2 hours of patching to full-time Bangerter foil wear
 - Ultimately only half line difference (in favour of patching) in mean VA improvement between both methods
 - Lower burden of treatment with Bangerter foils

A Randomized Trial Comparing Bangerter Filters and Patching for the Treatment of Moderate Amblyopia in Children. *Ophthalmology*. 2010;117(5):998-1004.e6.

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JR (5y/o) – June 18, 2020 – Other OD 6 y/o- December 28, 2020 – Other OD

- | | |
|---|---|
| <ul style="list-style-type: none"> ▪ Aided Distance Visual Acuity <ul style="list-style-type: none"> • OD: 20/80+2 OS: 20/25 • No information on Crowded vs Uncrowded ▪ Cover Test <ul style="list-style-type: none"> • Distance: Non-strab • Near: Right Esotropia (constant/intermittent?) ▪ Subjective <ul style="list-style-type: none"> • OD: +4.50 - 20/60-2 • OS: +1.50 - 20/25+2 • Note: reduced ET with +6.00 only, but VA was 20/100 ▪ Final Rx <ul style="list-style-type: none"> • OD: +4.00 OS: +1.50 ADD: +1.50 OU | <ul style="list-style-type: none"> ▪ Aided Distance Visual Acuity <ul style="list-style-type: none"> • OD: 20/50+1 OS: 20/25 ▪ Cover Test: <ul style="list-style-type: none"> • Near: 6pd Right Esotropia (constant/intermittent?) |
|---|---|

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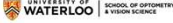
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JR (5y/o) – June 18, 2020 – Other OD 6 y/o- December 28, 2020 – Other OD

- Aided Distance Visual Acuity
 - OD: 20/80+2 OS: 20/25
 - No information on Crowded vs Uncrowded
- Cover Test
 - Distance: Non-strab
 - Near: Right Esotropia (constant/intermittent?)
- Subjective
 - OD: +4.50 - 20/60-2
 - OS: +1.50 - 20/25+2
 - Note: reduced ET with +6.00 only, but VA was 20/100
- Final Rx
 - OD: +4.00 OS: +1.50 ADD: +1.50 OU

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1 year later - JR (7y/o) – Jan 4, 2022 – 2nd OD

- Aided Distance Visual Acuity
 - OD: 20/60+2 OS: 20/25
 - No information on Crowded vs Uncrowded
- Cover Test
 - Distance: Non-strab
 - Near: 6pd Right Esotropia (constant/intermittent?)
- Subjective
 - OD: +5.50 - 20/50-2
 - OS: +3.50 - 20/25+2
- Final Rx
 - OD: +4.00 OS: +1.50 ADD: +1.50 OU
- Plan: Counselling on VT vs patching

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JR- 8 y/o- January 20, 2023 – Dr. N takes over

- Case history: generally wears glasses full-time, does not really read, not very skilled at it yet
- Aided Visual Acuity
 - Distance OD: 20/50+1 OS: 20/25
 - Single line VA, no improvement with single letter
 - Tended to look through bifocal in distance
 - Near: OD: 1.0M OS: 0.4M
 - Uncrowded single letters
- Cover Test:
 - Distance: 3 esophoria
 - Near: 3 esophoria
- Stereo: 400" animals, no global (Random Dot)
- Retinoscopy over glasses: +0.50 OD, +1.00 OS
- MEM Retinoscopy (through bifocal)
 - OD: +0.75 OS: +1.25
- Plan: Return to clinic for more thorough Rx trialing
 - Counselled on VT again and mom seems to be willing to go ahead with it after trialing glasses

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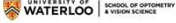
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JR- 8 y/o- February 17, 2023

- Aided Visual Acuity
 - Distance OD: 20/40+1 OS: 20/25
 - Single line VA – pushed hard to look
- Current Rx:
 - OD: +4.00 OS: +1.50 ADD: +1.50 OU
- Stereo (pre-trials): 140" local, no global (Random Dot)
- MEM Retinoscopy (through bifocal)
 - OD: +0.25 OS: +1.25
- Retinoscopy over glasses
 - OD: +0.50 OS: +1.00

Tried various amounts of lenses over specs:

- Stereo 70" local
- Final Rx:
 - OD: +4.25 OS: +2.25 ADD: +1.25 OU
- Plan: Return to clinic to assess VA/binocularity, consider BV Assessment/VT

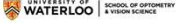
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JR- 8 y/o- April 23, 2023

- Aided Visual Acuity
 - Distance OD: 20/40 OS: 20/25
 - Single line VA
- Current Rx:
 - OD: +4.25 OS: +2.25 ADD: +1.25 OU
- Stereo: 70" local, no global (Random Dot)
- MEM Retinoscopy (through bifocal)
 - OD: +0.25 OS: +0.25
- Retinoscopy over glasses
 - OD: pl OS: -0.25

Plan: RTC for BV Assessment

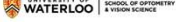
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How Can We Further Treat This?

If not patching, then what? Do we consider any of the other options?

What are our training options if not wanting to do patching/Bangerter foil or penalization?

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Amblyopia Methods of Treatment

- Wearing/updated refractive correction

Traditional Monocular Treatments:

- Occlusion Patching
- Penalization with Atropine

Alternative Monocular Treatment:

- Bangerter Foil

Exercises/Therapy

- Monocular Perceptual Learning
- Dichoptic Therapy
- Vision Therapy

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Monocular Perceptual Learning

- Perceptual learning (PL) with respect to vision involves a range of monocular tasks that train the amblyopic eye to perform better over time, including:
 - Vernier acuity
 - Contrast detection
 - Letter identification and position discrimination
- May help with fixation and accommodation of amblyopic eye?
- As with any patching-type monocular treatment, best paired with "active" stimulation of amblyopic eye versus passive
 - i.e. PL could help shorten duration of treatment required (i.e. instead 2-6 hours of patching)

Levi DM, Li RW. Perceptual Learning as a potential treatment for amblyopia: a mini-review. *Vision Res.* 2009;49(21):2535.

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Dichoptic Therapy - Is Amblyopia a Monocular Problem?

- If etiology is the early onset of binocular dysfunction leading to suppression of the affected eye and defective stereoacuity... then is it more a binocular problem with both monocular and binocular consequences?

Hug T, Legate J, Fortenbacher DL, Press LJ. Point-counterpoint: a monocular or binocular approach to amblyopia treatment? *NJ Clin Insights Eyecare.* 3:2025.


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Dichoptic/Binocular Therapy

- Various methods being studied, working under anti-suppression principle
 - Falling blocks
 - Dig Rush
 - Tetris games
 - i-Bit system games
 - Virtual Reality One
 - Barron Vision Software
 - Diplopia game
 - Etc
- Usually emphasizing higher contrast/quality images to amblyopic eye or solely presenting important elements to the amblyopic eye.
- VR-type systems may employ foreground elements only to amblyopic eye ensuring preferential stimulation of amblyopic eye
- Varied "dosage" from 20min-2hrs/day or sometimes per week depending on study
- Varied duration from 2 weeks to 24 weeks

Tsani Z, Ioannopoulos D, Androudi S, et al. Binocular treatment for amblyopia: a systematic review. *Int Ophthalmol* 2024 441: 2024-441(1):362-. doi:10.1007/s10792-024-03209-7

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Dichoptic/Binocular Therapy


- Shown to be promising, and in many studies, non-inferior to patching therapy for VA and stereoacuity improvement
- Improvements in adults as well in prospective interventional study (18-40 years old) with VisuoPrime software when done for 30 min daily for 6 weeks
 - MFBF Therapy (Monocular Fixation Binocular Field)
 - Home-based treatment

Hakiki MH, Alhabwani B. The efficacy and safety of dichoptic therapy in comparison to patching in children with amblyopia: A systematic review and meta-analysis. *Acta Ophthalmol*. 2020;104(2):e199-e201.

Thompson, B., Concetta Morrone, M., Ben, P., Lozama, A., & Sabel, B. A. (2024). Harnessing brain plasticity to improve binocular vision in amblyopia: An evidence-based update. *European Journal of Ophthalmology*, 34(4), 901-912.

Tsani Z, Ioannopoulos D, Androudi S, et al. Binocular treatment for amblyopia: a systematic review. *Int Ophthalmol* 2024 441: 2024-441(1):362-. doi:10.1007/s10792-024-03209-7

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Dichoptic/Binocular Therapy

Adherence compared to Patching?


- More demanding of attention than patching IF game is engaging – Active vs passive treatment
- Other studies show patients not engaging in dichoptic therapy due to unengaging nature of activity for prolonged periods of time
 - Improved when dichoptic therapy was supervised
- May not always be in continuous doses either (lots of pausing and playing in smaller bursts)

Hakiki MH, Alhabwani B. The efficacy and safety of dichoptic therapy in comparison to patching in children with amblyopia: A systematic review and meta-analysis. *Acta Ophthalmol*. 2020;104(2):e199-e201.

Thompson, B., Concetta Morrone, M., Ben, P., Lozama, A., & Sabel, B. A. (2024). Harnessing brain plasticity to improve binocular vision in amblyopia: An evidence-based update. *European Journal of Ophthalmology*, 34(4), 901-912.

Tsani Z, Ioannopoulos D, Androudi S, et al. Binocular treatment for amblyopia: a systematic review. *Int Ophthalmol* 2024 441: 2024-441(1):362-. doi:10.1007/s10792-024-03209-7

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Dichoptic/Binocular Therapy

Limitations:

- Can this really be done for everyone? Infants? Patients with cognitive delays or intellectual disability?
- Can dichoptic therapy always be supervised? Should it be?
- Are all of these games engaging beyond the first couple of days (playing hours of the same game)?
- Is this accessible to all clinics?
- Many studies done in anisometropic amblyopes or those with strabismus angle less than 10pd (in order to employ prism while doing the activity if necessary). Does that mean large angle strabismus patients must utilize monocular-focused treatments?

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1 year later - JR 9 y/o- BV Assessment - February 2, 2024

- Aided Visual Acuity
 - Distance OD: 20/40 OS: 20/25
 - Single line VA
- Current Rx:
 - OD: +4.25 OS: +2.25 ADD: +1.25 OU
- Cover Test:
 - Distance/Near: 5 esophoria (maybe intermittent esotropia at both distances?)
- Stereo: 70" local, **no global** (Random Dot)
- Worth 4 Dot:
 - alternating fusion/uncrossed diplopia at near
 - Alternating OD suppression/flickering fusion at intermediate distance
- MEM Retinoscopy (through bifocal)
 - OD: +0.25 OS: +0.25
- Amplitude of Accommodation (Sheard's):
 - OD: 3.5D OS: 11D
- Accommodative Facility (through distance carrier):
 - OD: Unable to clear even -1.00
 - OS: 15cpm (harder with +2.00 over time)
- NFV at Dx: supp @4pd PFV at Dx: 3/14/12
- Suppression of NFV/PFV at near
- Assessment: Anisometropic Amblyopia OD, Basic Intermittent Right Esotropia with suppression, Accommodative Insufficiency OD

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Vision Therapy (Monocular Treatments)

Study comparing monocular perceptual learning, to VT + 2 hours of patching, and patching alone.

- Vision therapy was 3x/week consisted of:
 - Accommodation exercises such as Near/Far Hart Chart
 - Eye-hand coordination exercises consisting of mazes, filling-in letters of decreasing size etc.
 - Ocular motility with Marsden Ball, following movements of a pointer and space fixator for saccadic eye movements
- Demonstrating activities where the fovea is most active
- Vision Therapy more effective than both perceptual learning and patching alone in improving visual acuity and stereoacuity
 - Patients were found to be more engaged in VT activities than in monocular perceptual learning task and patching (i.e. lower adherence)

Hernández-Andrés R, Serrano MÁ, Alarcos-Crespo A, Luque MJ. Randomised trial of three treatments for amblyopia: Vision therapy and patching, perceptual learning and patching alone. *Optom Vis Sci*. 2024;101(2):139-142.

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Vision Therapy for JR – Monocular/Binocular

- Accommodation
 - Monocular/Binocular Accommodative Rock
 - Mental Minus
- Oculomotor
 - Hart Chart Saccades
 - Binovi Central-Peripheral saccades
 - Marsden ball hunting
 - Word searches
 - Mazes
- Vergence/Antisuppression
 - Vectograms (near and projected)
 - Vision Builder Random Dot
 - Brock String
- Anti-suppression
 - Pola-mirror (Vis-a-vis)
 - GTVT
 - Any Red/Green Bar Acetate activity
- Peripheral Awareness
 - Bilateral Circles
 - Space Fixator
- MFBF (Monocular Fixation Binocular Field)
 - Binocular (Red/Green)

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JR 9 y/o– VT Progress Check 1 - June 21, 2024

- Aided Visual Acuity
 - Distance OD: 20/20-2 OS: 20/20
 - Single line VA
- Current Rx:
 - OD: +4.25 OS: +2.25 ADD: +1.25 OU
- Cover Test:
 - Distance/Near: 5 esophoria (possible intermittent eso at distance?)
- Stereo: 70" local, no global (Random Dot)
- Worth 4 Dot:
 - Fusion at near (no alternating diplopia)
 - Alternating OD suppression/flickering fusion at intermediate/distance
- MEM Retinoscopy (through bifocal)
 - OD: +0.50 OS: +0.75
- Amplitude of Accommodation (Shear's):
 - OD: 10.5D OS: 11D
- Accommodative Facility +/-2.00 (through distance carrier):
 - OD: 12cpm OS: 15cpm OU: supp through distance carrier
- NFV at Dc: supp PFV at Dc: x/14/10
- NFV at Nc: x/12/10 PFV at Nc: x/30/25
- Retinoscopy over Glasses
 - OD: Pl-0.50x180 OS: +1.00-0.50x180
- Final Rx:
 - OD: +4.50 OS: +2.75 ADD: +1.25 OU
- Plan: Come back for second set of VT to work on fusion in the distance and stereo.
- Mom's plan: Insurance ran out, will do again next year...

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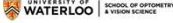
JR 10 y/o– VT Progress Check 2 - June 20, 2025

- Aided Visual Acuity
 - Distance OD: 20/25-2 OS: 20/20
 - Single line VA
- Current Rx:
 - OD: +4.75 OS: +2.75 ADD: +1.25 OU
- Cover Test:
 - Distance/Near: 5 esophoria (maybe intermittent esotropia at both distances?)
- Stereo: 70" local, 500" global (Random Dot)
- Worth 4 Dot:
 - Fusion at near (no alternating diplopia)
 - Alternating OD suppression/fusion at intermediate/distance
- MEM Retinoscopy (through bifocal)
 - OD: +0.50 OS: +0.75
- Accommodative Facility (through distance carrier):
 - OU: 9cpm (no suppression!)
- Plan: 3 month post-VT check, continue homework though

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JR 10 y/o– Post-VT check - September 19, 2025


- Aided Visual Acuity
 - Distance OD: 20/25-2 OS: 20/20
 - Single line VA
- Current Rx:
 - OD: +4.75 OS: +2.75 ADD: +1.25 OU
- Cover Test:
 - Distance/Near: 5 esophoria, no strabismus seen?
- Stereo: 30" local, 500" global (Random Dot)
 - Achieved by adding -0.50 OU!
- Worth 4 Dot:
 - Fusion at near (no alternating diplopia)
 - Fusion at intermediate/distance
- MEM Retinoscopy (through bifocal w/ -0.50 OU)
 - OD: +0.75 OS: +0.75
- NFV Nc: 3/16/12
- Final Rx:
 - OD: +4.25 OS: +2.25 ADD: +1.25 OU
- Plan: 6 months for routine OVA

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JR 11 y/o– Routine Exam - April 24, 2026


- Aided Visual Acuity
 - Distance OD: 20/25-2 OS: 20/20
 - Single line VA
- Current Rx:
 - OD: +4.25 OS: +2.25 ADD: +1.25 OU
- Cover Test:
 - Distance/Near: 5 esophoria
- Stereo: 20" local, 500" global (Random Dot)
- Worth 4 Dot:
 - Fusion at near (no alternating diplopia)
 - Fusion at intermediate/distance
- Plan: RTC for annual routine exam

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Key Takeaways

- Spend some time tinkering with your prescription based on your binocular findings.
 - What improves your binocular findings? It may be reducing the anisometropia between the eyes
- Consider other forms of monocular treatments before patching due to low adherence and greater burden on patients/parents
 - And if so, add "active" components to increase effectiveness
- Dichoptic and binocular therapies are promising, but still need more time and research (if we are considering dichoptic-type games)
- Vision therapy combines many of these components – Work on monocular skills while trying to encourage binocularity when possible

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QUESTIONS?
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