MYOPIA 2025
DILATE OR DILUTE?

CONSIDERING MANAGEMENT CHANGE WITH PROGRESSIVE MYOPIA

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WAVE 23/3/2025

Wave 2025

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THE UNIVERSITY OF WESTERN AUSTRALIA

SEEK WISDOM

Eye Health Centre of Western Australia

ABOUT ME

Lecturer @ UWA/ Optometrist at EHCWA

Refugee Clinic (in collaboration with Lions Inreach Vision)

University of Western Australia 2022

Interests: Myopia Management

Binocular Vision; Strabismus and Amblyopia, Vision Therapy

Journey:

Australian College of Optometry
Private Practice (Metro/Rural in Victoria)

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LEARNING OBJECTIVES

- Understand what level of myopia progression is acceptable at different ages
- Understand how different treatments may interact with each other
- Consider how a change in binocular vision may impact management choice

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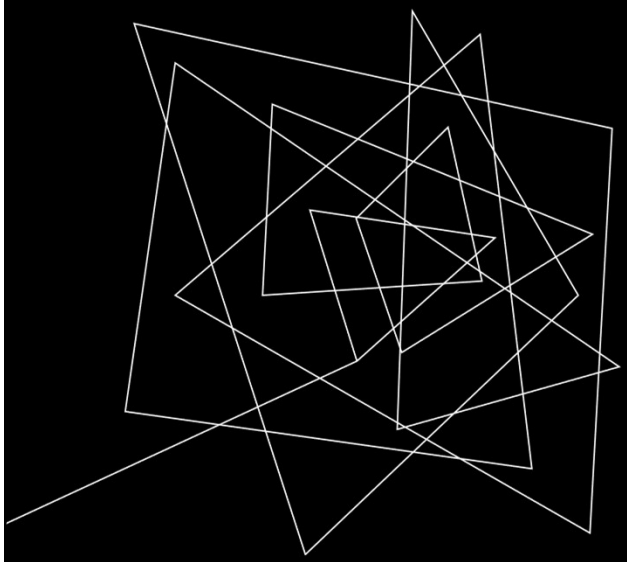

MYOPIA PROGRESSION

How much change is significant?

Should we have the same cut-off for action for starting treatment, and modifying treatment?

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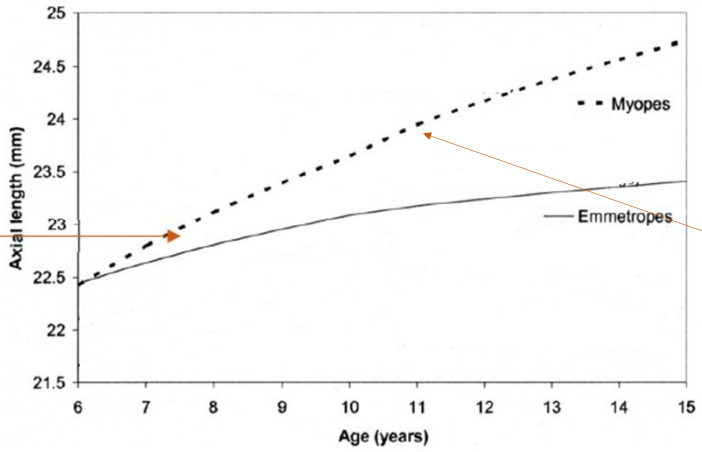
WHAT IS NORMAL PROGRESSION?

Slope steeper



More time to keep progressing

MYOPES

COMET (pre myopia control): **for myopes** average age of axial length stabilization was **15.6±4.2** years and progression **~0.3**mm/year when younger; **0.2** when older)

EMMETROPES

- Age 6: 1-1.5mm additional growth
- Emmetropic growth (~around 0.1mm/year on average, *but faster initially then slows to a stop)*

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IMPLICATIONS FOR TREATMENT

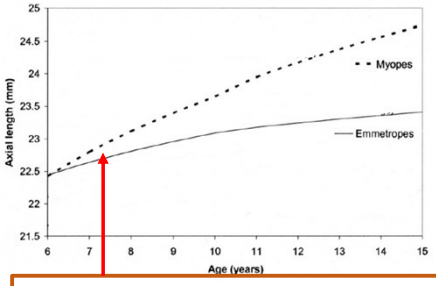
YOUNGER CHILDREN (<10) NEED MORE AGGRESSIVE TREATMENT

Treatment is long-term – may be 6-12 years depending on age of onset.

- *Younger children are also more tolerant of side effects that might bother an older child.*

Older children progress more slowly, and are more likely to be bothered by side-effects

→ Start on a lower dose, increase when settled if progressing (1-3 months)



Intervene here to flatten curve to "emmetropic like" growth and reduce final myopic outcome

"Younger children required higher concentrations to achieve similar reductions in myopic progression as older children who were treated by lower concentrations.[37] The concentration-dependent effect among 0.05%, 0.025%, and 0.01% atropine lessened with age" YAM 2022 (Lamp 3)

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HOW MUCH AXIAL LENGTH CHANGE WARRANTS **STARTING** TREATMENT?

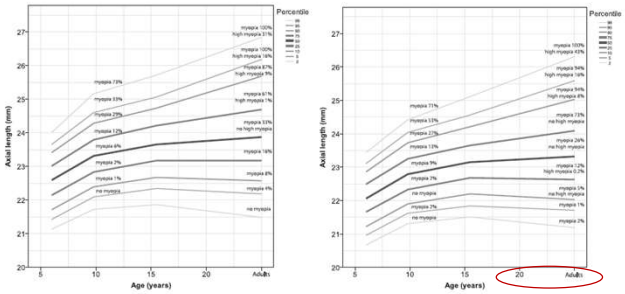
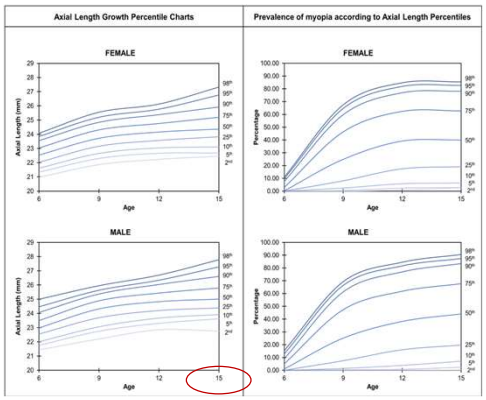


Fig. 2. Growth chart depicting axial length (in mm) versus age for European study subjects, males (left) and females (right), with the risk of myopia in adulthood. The myopia percentage represents the proportion of myopia in halfway above and below the percentage line.

- Different expected lengths and rates of change depending if Asian or Caucasian (Asian eyes longer and grow faster ever for emmetropes)



Tideman 2018 (European) +Diez (Chinese) 2019

0.1mm/yr is expected for emmetropes
0.2-3mm/yr warrants treatments

If they are a child and myopic and refraction is increasing they should be on treatment

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Tideman 2018 (European)

HOW MUCH AXIAL LENGTH CHANGE WARRANTS A **CHANGE** IN TREATMENT?

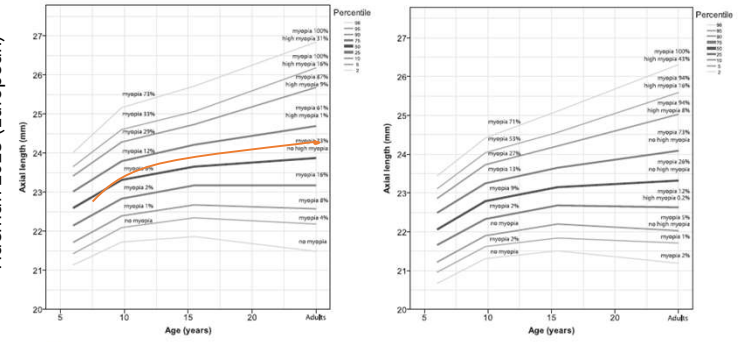
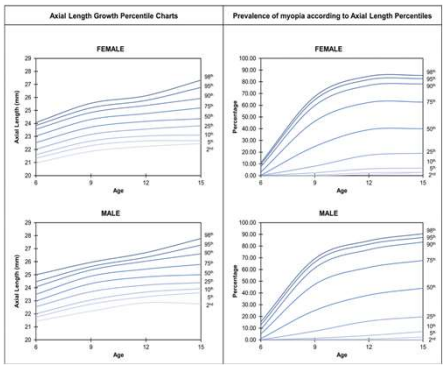


Fig. 2. Growth chart depicting axial length (in mm) versus age for European study subjects, males (left) and females (right), with the risk of myopia in adulthood. The myopia percentage represents the proportion of myopia in halfway above and below the percentage line.

Progression over 0.5D/year warrants an increase or change in treatment

Australian data: 2024 Doi:10.1111/ceo.14289

Diez (Chinese) 2019



- Aim to stay within the percentile bracket for their AL
- If AL change is >0.2mm/year(<age 10) consider increasing or adding treatment. If over 10, aim for <0.1mm

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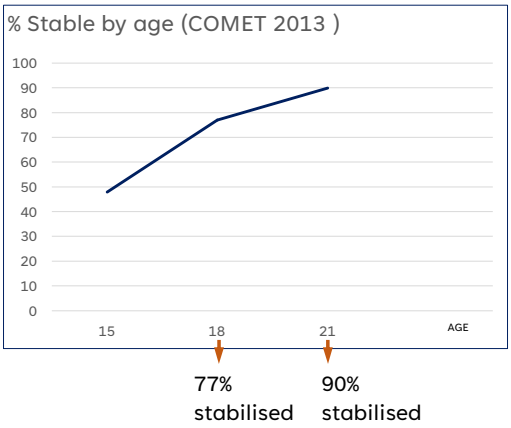
WHEN SHOULD WE **STOP TREATMENT**? (WHEN DOES CHILDHOOD MYOPIA STABILISE)?

- At least 25% of myopes continue to progress after the age of 18
- 50% will have stabilised by age 15.
- Boys stabilise later than girls
- "Average" ages reported have large standard deviations (+/-4 years)



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AVAILABLE TREATMENTS

No "one size fits all"

- different treatments may be more appropriate depending on age, refractive error and ethnicity.
- Discuss all available options with the parent and child, based on your assessment of their risk of progression, their particular clinical elements (e.g. astigmatism, allergy, dry eye etc) and their lifestyle requirements.
- If you are making recommendations outside the evidence base, be up front about this:
  - E.g. adult in 20s, myopia of -9.00, neurodiverse, pathological myopia etc.

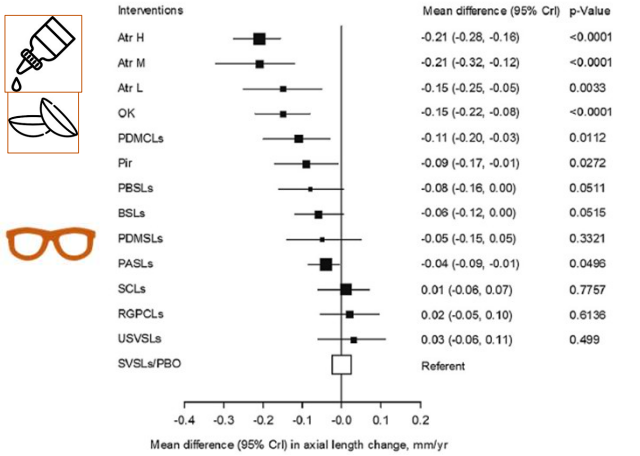

Figure 3. Results of network meta-analysis using single vision spectacle lenses/placebo as referent intervention. Atr ¼ atropine; Atr H ¼ high-dose atropine (1% or 0.5%); Atr L ¼ low-dose atropine (0.01%); Atr M ¼ moderate-dose atropine (0.1%); BSLs ¼ bifocal spectacle lenses; CrI ¼ credible interval; Cyc ¼ cyclopentolate; MOA ¼ more outdoor activities (14e15 hrs/wk); OK ¼ orthokeratology; PASLs ¼ progressive addition spectacle lenses; PBO ¼ placebo; PBSLs ¼ prismatic bifocal spectacle lenses; PDMCLs ¼ peripheral defocus modifying contact lenses; PDMSLs ¼ peripheral defocus modifying spectacle lenses; Pir ¼ pirenzepine; RGPCLs ¼ rigid gas-permeable contact lenses; SCLs ¼ soft contact lenses; SVSLs ¼ single vision spectacle lenses; Tim ¼ timolol; USVSLs ¼ undercorrected single vision spectacle lenses.

Huang 2016 Ophthalmology 2016;123:697-708

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DO THESE TREATMENTS WORK FOR ADULT-ONSET MYOPIA?

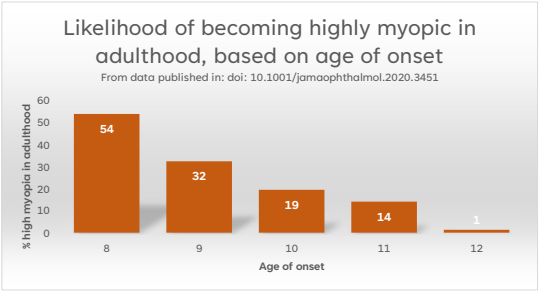
- Not many studies on why adults go myopic– **natural history not well understood**
- As most adults aren't progressing, difficult to get meaningful statistics
- **No studies on whether treatment is effective**

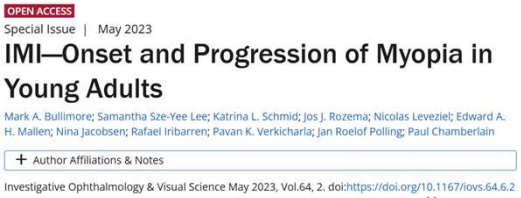
Some treatments will impact on adult activities eg driving at night

- Typically need less aggressive treatment (OK with larger optic zone, atropine 0.01%, MF CLs with +1. Myopia controlling lenses may not be ideal for patients who are driving

A good summary of what we know so far can be found here:

IMI paper on adult onset myopia (2023): https://doi.org/10.1167/iovs.64.6.2




OPEN ACCESS
Special Issue | May 2023
IMI—Onset and Progression of Myopia in Young Adults
Mark A. Bullimore; Samantha Sze-Yee Lee; Katrina L. Schmid; Jos J. Rozema; Nicolas Leveziel; Edward A. H. Mallen; Nina Jacobsen; Rafael Iribarren; Pavan K. Verkicharla; Jan Roelof Polling; Paul Chamberlain
+ Author Affiliations & Notes
Investigative Ophthalmology & Visual Science May 2023, Vol.64, 2. doi:https://doi.org/10.1167/iovs.64.6.2

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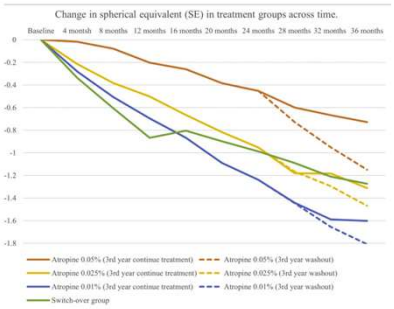
WHAT ABOUT REBOUND?



LAMP Phase 3 2022

"Continued atropine treatment at any of the 3 concentrations (0.05%, 0.025%, and 0.01%) confers better efficacy than stopping treatment."

For atropine, using lower doses reduces rebound but so does **stopping treatment later.**

For older children (12+), rebound was similar between doses.

Take Home Message

Rebound occurs with ALL Myopia treatments if you stop too early.

Sanchez-Tena 2024 doi:10.1111/opo.13277

To reduce rebound:

- **Wait for progression to stop before discontinuing treatment**
- Taper dose to lower amount before cessation (atropine) or reduce from two treatments to one
- Transition from atropine → optical prior to discontinuing treatment
- Monitor carefully (3/12) for progression, and consider restarting treatment if progression

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BINOCULAR VISION

Accommodation insufficiency/convergence excess can make myopia management more difficult.

- Increasing myopia makes these worse
- SVD not the treatment of choice for these patients
- Prior to myopia management considerations… we used MF

If you have a patient with AI/CE, Myopia Controlling Specs may not be the best option – **always check MEM and AC/A** prior to prescribing.

If you are prescribing atropine to these patients, consider rechecking accommodation prior to updating specs to incorporate an add if necessary.

Gwiazda 2004 doi.org:10.1167/iovs.03-1306

SVD & Myopia Controlling Specs

OrthoK & MF soft CLs

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4. DISCUSS ENVIRONMENTAL CONSIDERATIONS EVEN IF THEY ARE ON TREATMENT

Covid-era data comprehensively demonstrated that reduced outside time increases the rate of progression EVEN FOR PEOPLE ON TREATMENT

Limit blocks of near work >30mins

Ensure working distance >30cm

Increase WD if you can

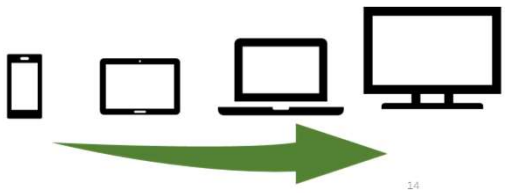
Influence of coronavirus disease 2019 on myopic progression in children treated with low-concentration atropine

Hae Ri Yum, Shin Hae Park, Sun Young Shin

Published: September 14, 2021 • https://doi.org/10.1

Original Investigation | Ophthalmology

Evaluation of an Optical Defocus Treatment for Myopia Progression Among Schoolchildren During the COVID-19 Pandemic



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ARE MULTIPLE MODALITIES ADDITIVE?

- Likely that atropine works via a different mechanism to the others

  → therefore adding atropine to other modalities eg myopia specs or orthok seems sensible

- As new modalities come on board, it takes time to develop data to
  - demonstrate effect over time
  - See if effects of multiple treatments are additive (this will take time and it is still early days)


Randomized Controlled Trial > Ophthalmology. 2024 Nov;131(11):1304-1313.
doi: 10.1016/j.ophtha.2024.05.015. Epub 2024 May 18.

Myopia Control Effect of Repeated Low-Level Red-Light Therapy Combined with Orthokeratology: A Multicenter Randomized Controlled Trial

Ruilin Xiong [1], Wei Wang [1], Xianghua Tang [1], Meinan He [2], Yin Hu [1], Jian Zhang [1], Bei Du [2], Yu Jiang [3], Zhuoting Zhu [4], Yanping Chen [1], Shiran Zhang [1], Xiangbin Kong [5], Ruihua Wei [2],

A comparison of myopia control in European children and adolescents with defocus incorporated multiple segments (DIMS) spectacles, atropine, and combined DIMS/atropine

Paolo Nucci, Andrea Lembo, Irene Schiavetti, Rakhee Shah, David Francis Edgar, Bruce John William Evans

Published: February 16, 2023 • https://doi.org/10.1371/journal.pone.0281816

ORIGINAL INVESTIGATIONS

Effect of Combining 0.01% Atropine with Soft Multifocal Contact Lenses on Myopia Progression in Children

Jones, Jenny Huang PhD, OD, MPH[1]; Mutti, Donald O. OD, PhD, FAAO[1]; Jones-Jordan, Lisa A. PhD, FAAO[1]; Walline, Jeffrey J. OD, PhD, FAAO[1]

Author Information

Optometry and Vision Science 99(5):p 434-442, May 2022. | DOI: 10.1097/OPX.0000000000001884

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SOME REPORTED COMBINATIONS

- OrthoK + 0.01 (2022 DOI: 10.1186/s12886-022-02635-0)
- Miyosmart+0.025/ Miyosmart + 0.01%
  (*, 2022 doi.org/10.1038/s41598-022-25599-z)
- Stellest + 0.01 (*)
- MF + atropine 0.01 % (2022 *DOI:* 10.1097/OPX.0000000000001884



No improvement

Many are retrospective and/or small studies: this will be a developing space

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TREATMENT OPTIONS

No variation possible possible	Limited variation possible	Increasing dose
Myopia Controlling Lens: (Maximise wearing time)	Orthokeratology (Reduce size of optic zone)	Atropine Increase dose
ADD TREATMENT (ATROPINE)	**ADD TREATMENT (ATROPINE)**	**INCREASE TREATMENT**
Soft MF Contact Lens (daily) (Maximise wearing time)	Soft MF Contact Lens (Biofinity) (Increase add to +2.50))	
CHANGE TREATMENT (e.g. OK)	**CHANGE TREATMENT (e.g. OK)**	

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SHOULD WE START EVERYONE ON COMBINATION THERAPY?

You are conducting an experiment on an "n of 1"

- Start with one treatment.
- Monitor for impact compared with emmetropic rates of change
- Be wary of patients with AI/CE – start with one treatment and manage the impact on BV as necessary

- If **insufficient control**, then add or change management options

"Combination therapy seems to be more effective than a single treatment approach, and **so should be considered if myopic progression continues."**

IMI 2021 "Reflections on the Implications for Clinical Practice"

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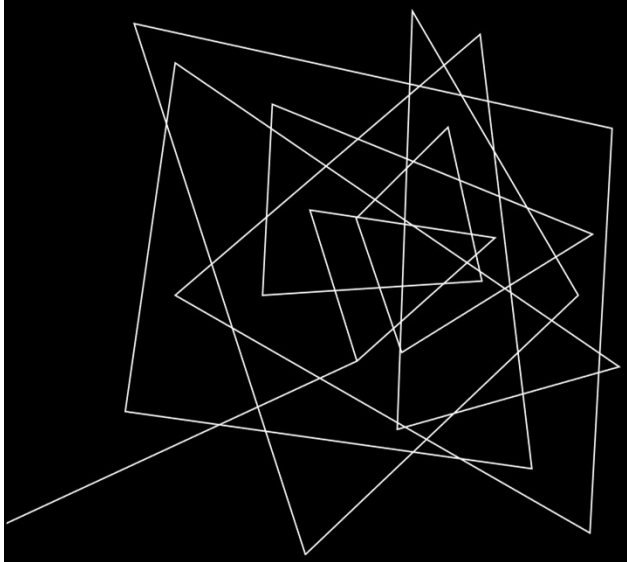

CASE STUDIES OF MANAGEMENT CHANGE

What might trigger an escalation of treatment?

When would you taper?

When might you jump ship to alternate treatment?

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Case 1 - Luke

Caucasian, age 13

1st rx age 7; 1 parent myopic; 4 hours/day outside

Started on atropine 0.05% end 2022

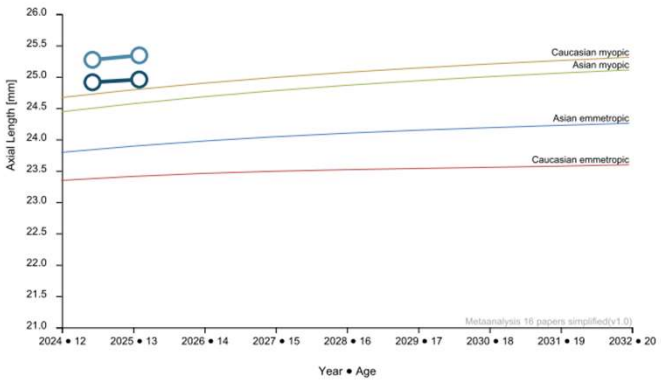
Significant photophobia – used intermittently

Axial length change R0.11 L0.00 in 12/12 prior to first visit with us.

Changed to Atropine 0.025% to reduce symptoms

At reviews: No longer has issues with glare; happy in current MF for D&N (rx 12/12 old)

No change in rx from last visit – continue on 0.025%



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Case 2 – Ben

Caucasian, age 13

1st rx age 10; 1 parent myopic; 1-2 hours/day outside

Started on atropine 0.025% end 2023 as rx had changed by ~1D in 12 months

No symptoms on atropine 0.025% but continued to progress

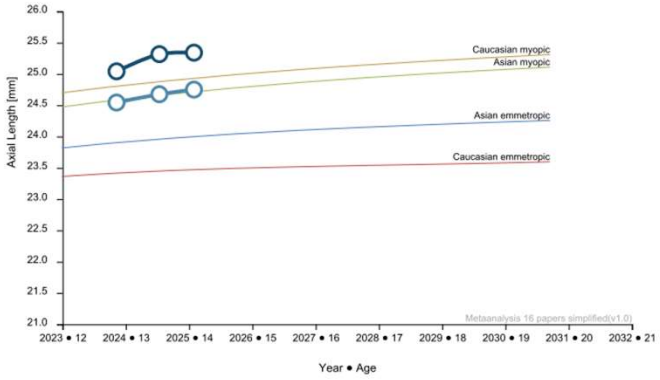
Axial length change R0.28 L0.14 in 7/12

Changed to Atropine 0.05% to reduce progression

At reviews: No issues with glare, no BV changes

Axial length stabilised (R0.02 L0.07 in 6/12)

Continue Atropine 0.05%



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CHANGING MANAGEMENT

Increase dose or add treatment if:	Refractive error is increasing by >0.50/year
	Axial length continues to increase by >0.15mm per year
Decrease dose or remove treatment if:	Child is over the age of 14
	Demonstrated stability on current treatment >12/12
	If on atropine, reduce dose 0.05→0.025→0.01 and monitor carefully for progression
	Consider change to optical alternative (e.g. CL's) for continued control +lifestyle advantages
Change to alternative modality if:	Binocular vision findings are unacceptable in current approach
	Allergy/sensitive to drops at effective dose
	Change in lifestyle requirements (increased sport etc)

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Complexity (SV→MF)

Age (atropine to CLs)

	If BV normal	If astigmatism	If AI/CE
Child ≤ 9	Atropine 0.05% (+SVD) Myopia specs	As for ←	Atropine + MF Rx (OrthoK)
Child ≤ 10-12	Atropine 0.025% - (→ 0.05%) Myopia specs Consider CL's (orthok/MF soft)	As for ← (but no daily soft MF)	Atropine + MF Rx OrthoK MF softs
Child ≤ +12	CL's Myopia specs Atropine 0.01→ 0.025%	OrthoK Atropine + SVD Myopia specs	CL's Atropine 0.01%+MF?

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SUMMARY

- Begin management early – be aggressive early as this is when the fastest progression happens.
  → Start conversations before the myopia begins
- Start with **one** treatment, monitor carefully and add additional treatment if insufficient effect
  - (AL change>0.15mm or >-0.50 in 12/12)
- Continue treatment while progressing (no need to stop/wash out)
  → this may continue into early 20's for some patients
- Consider swapping to contact lens treatments in teenage years – you are likely to change management throughout their journey.
- Keep an eye on the literature – guidelines and understanding changing rapidly.

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KEY REFERENCES

Keep an eye on the literature – new studies coming out all the time. IMI papers provide a good summary of current views.

Brennan NA, Nixon AD, Cheng X, Bullimore MA. Can we really distinguish 'responders' from 'non-responders' to myopia control interventions? Ophthalmic Physiol Opt. 2024;44(7):1363-1367. doi: 10.1111/opo.13379.

Gwiazda JE, et al. Accommodation and related risk factors associated with myopia progression and their interaction with treatment in COMET children. Investigative ophthalmology & visual science. 2004 Jul 1;45(7):2143-51.

Liang J, Pu Y, Chen J, et al. Global prevalence, trend and projection of myopia in children and adolescents from 1990 to 2050: a comprehensive systematic review and meta-analysis. Br J Ophthalmol. 2024. doi:10.1136/bjo-2024-325427

Sánchez-Tena MÁ, Ballesteros-Sánchez A, Martinez-Perez C, et al. Assessing the rebound phenomenon in different myopia control treatments: a systematic review. Ophthalmic Physiol Opt. 2024;44(2):270-279. doi:10.1111/opo.13277

Usmani E, Callisto S, Chan WO, Taranath D. Real-world outcomes of low-dose atropine therapy on myopia progression in an Australian cohort during the COVID-19 pandemic. Clin Exp Ophthalmol. 2023; 51(8): 775-780. doi:10.1111/ceo.14289

Yam JC, Zhang XJ, Zhang Y, et al. Three-year clinical trial of low-concentration atropine for myopia progression (LAMP) study: continued versus washout: phase 3 report. Ophthalmology. 2022 Mar 1;129(3):308-21.

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MYOPIA MANAGEMENT OPTIONS @ EHCWA

Option 1: Test only

$40

Let us know what tests you would like, and we'll send test results back to you for patient management.

Available technology

Haag-Streit Lens Star

Pentacam

Essilor Myopia Expert

Optopol revo FC OCT

Optos

Option 2: Refer for Management

$150, rebate ~$60

Referral letter detailing previous refractive (and axial length) hx and mx if known.

We will assess and manage within EHCWA

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MYOPIA PREVENTION

When should you start?

- Highest risk is <+0.75 at age 6 on cyclo
- Good data from age 4

Interventions

- **Time outside helps delay onset:** 2-3 hours/day
  - an increase of 1 hr/day reduces onset)
- Most optical/CL's solutions unnecessary if child not myopic
- **A drop of atropine before bed is easy and probably effective.**
- Early data suggests 0.05% may be better than 0.01%, at least for children of Chinese background (halved risk of going myopic compared with placebo) (doi:10.1001/jama.2022.24162)
- Some data that 0.01% effective in Indian and Caucasian children (DOI: 10.4103/ijo.IJO_1462_21)

TIME OUTDOORS

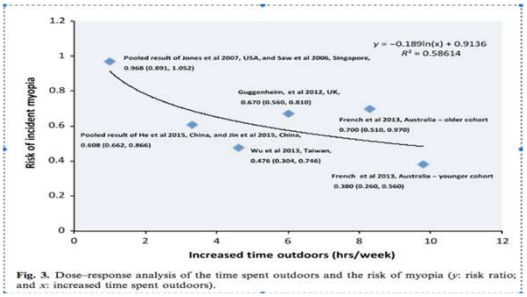
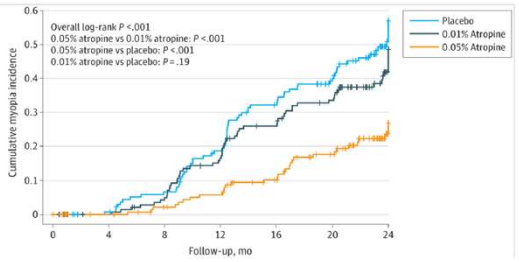


Fig. 3. Dose–response analysis of the time spent outdoors and the risk of myopia (*y*: risk ratio; and *x*: increased time spent outdoors).

Xiong doi:10.1111/aos.13403

LOW DOSE ATROPINE



YAM 2023 doi:10.1001/jama.2022.24162

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Supplementary Table 5. Side Effects and Adverse Events over three years.

	3) 0.05% Atropine						2) 0.025% Atropine						1) 0.01% Atropine					
	Continue (n=45)			Washout (n=45)			Continue (n=39)			Washout (n=39)			Continue (n=43)			Washout (n=43)		
	over 1 year	over 2 years	over 3 years	over 1 year	over 2 years	over 3 years	over 1 year	over 2 years	over 3 years	over 1 year	over 2 years	over 3 years	over 1 year	over 2 years	over 3 years	over 1 year	over 2 years	over 3 years
photochromic glasses needed	8 (17.8%)	8 (17.8%)	8 (17.8%)	18 (40%)	16 (35.6%)	7 (15.6%)	14 (35.9%)	15 (38.5%)	13 (33.3%)	16 (35.6%)	17 (43.6%)	12 (30.8%)	7 (16.3%)	7 (16.3%)	9 (20.9%)	21 (48.8%)	15 (34.9%)	11 (25.6%)
progressive glasses needed	0 (0%)	2 (4.4%)	2 (4.4%)	0 (0%)	1 (2.2%)	2 (4.4%)	0 (0%)	3 (7.7%)	4 (10.3%)	0 (0%)	2 (5.1%)	1 (2.6%)	1 (2.3%)	2 (4.7%)	4 (9.3%)	0 (0%)	4 (9.3%)	3 (7.0%)
photophobia	1 (2.2%)	3 (6.6%)	1 (2.2%)	1 (2.2%)	5 (11.1%)	1 (2.2%)	5 (12.8%)	1 (2.6%)	3 (7.7%)	1 (2.6%)	3 (7.7%)	0 (0%)	0 (0%)	3 (7.0%)	2 (4.7%)	4 (9.3%)	2 (4.7%)	1 (2.3%)
allergic conjunctivitis	1 (2.2%)	8 (17.8%)	2 (4.4%)	1 (2.2%)	2 (4.4%)	0 (0%)	3 (7.7%)	5 (12.8%)	2 (5.1%)	2 (5.1%)	6 (15.4%)	2 (5.1%)	3 (7.0%)	3 (7.0%)	2 (4.7%)	3 (7.0%)	2 (4.7%)	3 (7.0%)

LAMP Phase 3 Supplementary data

Surprisingly low #'s of MF and allergy (and no change when washout)

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