

Myopia: What would be your treatment of choice?

Drugs

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What pharmaceutical agents?

Tropicamide

Cyclopentolate

Atropine

Pirenzepine

Timolol

Atropine



Competitive, non-selective antagonist of muscarinic acetylcholine receptors

Used as

- Cycloplegic to temporarily paralyse accommodation reflex
- Mydriatic to dilate pupils

Atropine standard doses (1.0% & 0.5%)

- Peak cycloplegia after 1 hour
- Duration of mydriasis and cycloplegia 7 - 14 days
- Use is avoided for routine diagnostic cycloplegia
- Duration may cause intermittent esotropia \Rightarrow constant

Used therapeutically

- Anterior uveitis
- Penalisation as amblyopia therapy

Atropine, has long been known to be effective in reducing myopia progression in children (Gimbel, 1973; Kelly et al, 1975)

Gimbel HV (1973), The control of myopia with atropine. *Can J Ophthalmol*, 8; 527-532

Kelly et al (1975) Clinical assessment of the arrest of myopia, *Br J Ophthalmol*, 59; 529-538

Unwanted side effects in its standard
1% or 0.5% concentration

- Cycloplegia
- Mydriasis and photophobia
- Allergy

Atropine is also very toxic

Not widely used for myopia control

Serendipity

A trial in Singapore demonstrated that atropine 0.01% remained effective at reducing the rate of progression of myopia whilst having minimal effects on pupil size and accommodation (Chua et al, 2006)

Chua WH, et al 2006, Atropine for the treatment of childhood myopia, *Ophthalmology*, 113; 2285 - 91

The effects of different doses of atropine

Atropine for the Treatment of Myopia (ATOM) studies 1 & 2 demonstrated a dose-related response to atropine over 2-years

- Higher doses inhibited myopia progression to a slightly higher degree than lower doses (Chua et al, 2006; Chia et al, 2012)

Chia et al (2012) Atropine for the treatment of childhood myopia: safety and efficacy of 0.5%, 0.1% and 0.01% doses (ATOM 2) *Ophthalmology*, 119, 347-354

Effect of ceasing atropine of different doses

When atropine was stopped after 24 months for a period of 12 months (Phase 2 of ATOM 2 - *wash out period*)

- Rapid increase in myopia in children originally treated with higher concentrations of atropine

- Lowest concentration (0.01%) \Rightarrow minimal change (Tong et al, 2009; Chia et al, 2014)

Tong L et al (2009) Atropine for the treatment of childhood myopia: effect on myopia progression after cessation of atropine. *Ophthalmology*, 116; 572-579

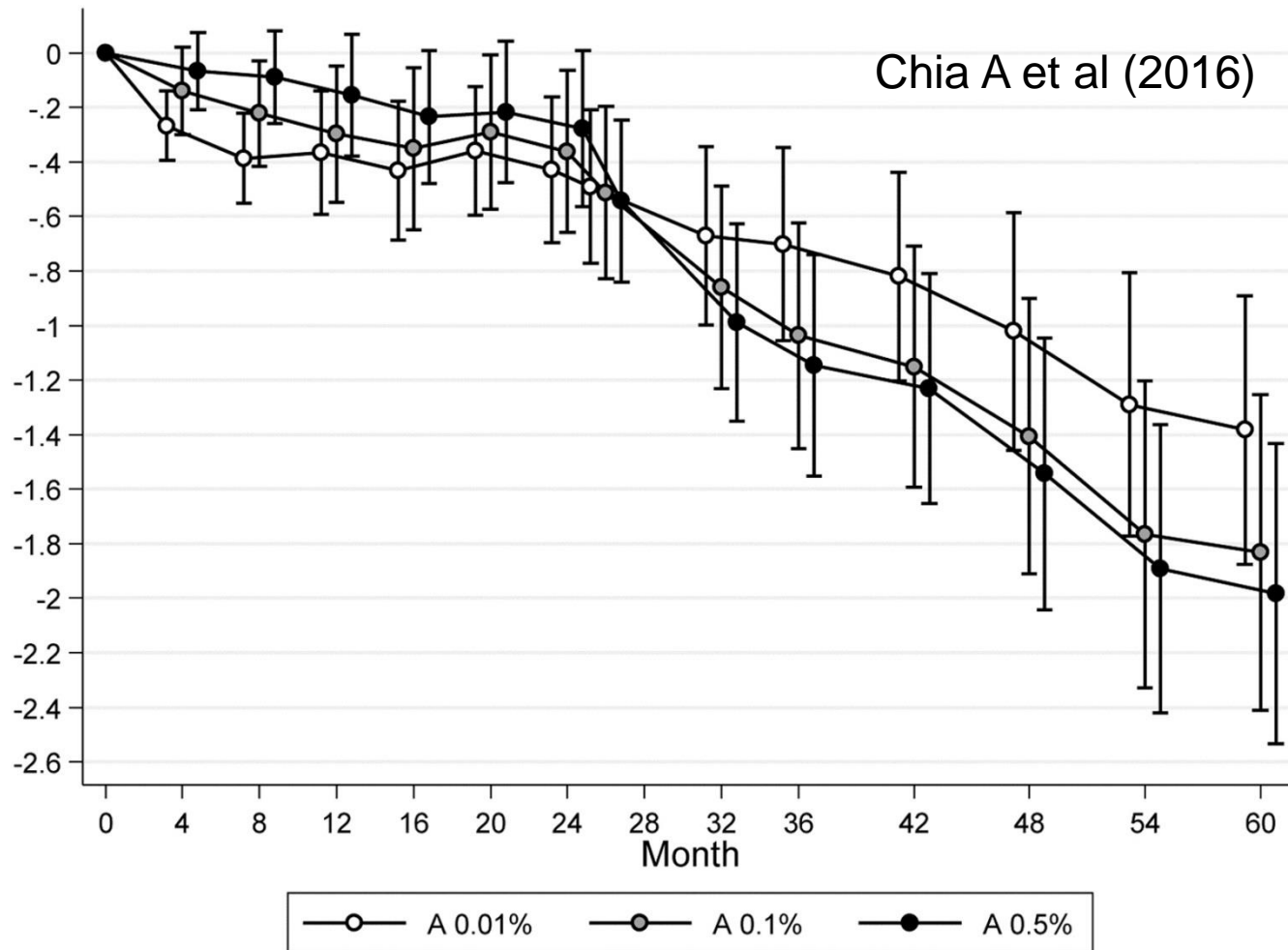
Chia A et al (2014) Atropine for the treatment of myopia : changes after stopping atropine 0.01%, 0.1% and 0.5% (ATOM 2) *Am J Ophthalmol*, 157; 451-457

- Net result - myopia progression significantly lower in children treated with 0.01% (-0.72D) at 36 months cf. 0.1% (-1.04D) and 0.5% (-1.15D)
- 0.01% caused
 - less photopic pupil dilation
 - no clinically significant loss of accommodation or
 - near VA (Chia et al, 2014)

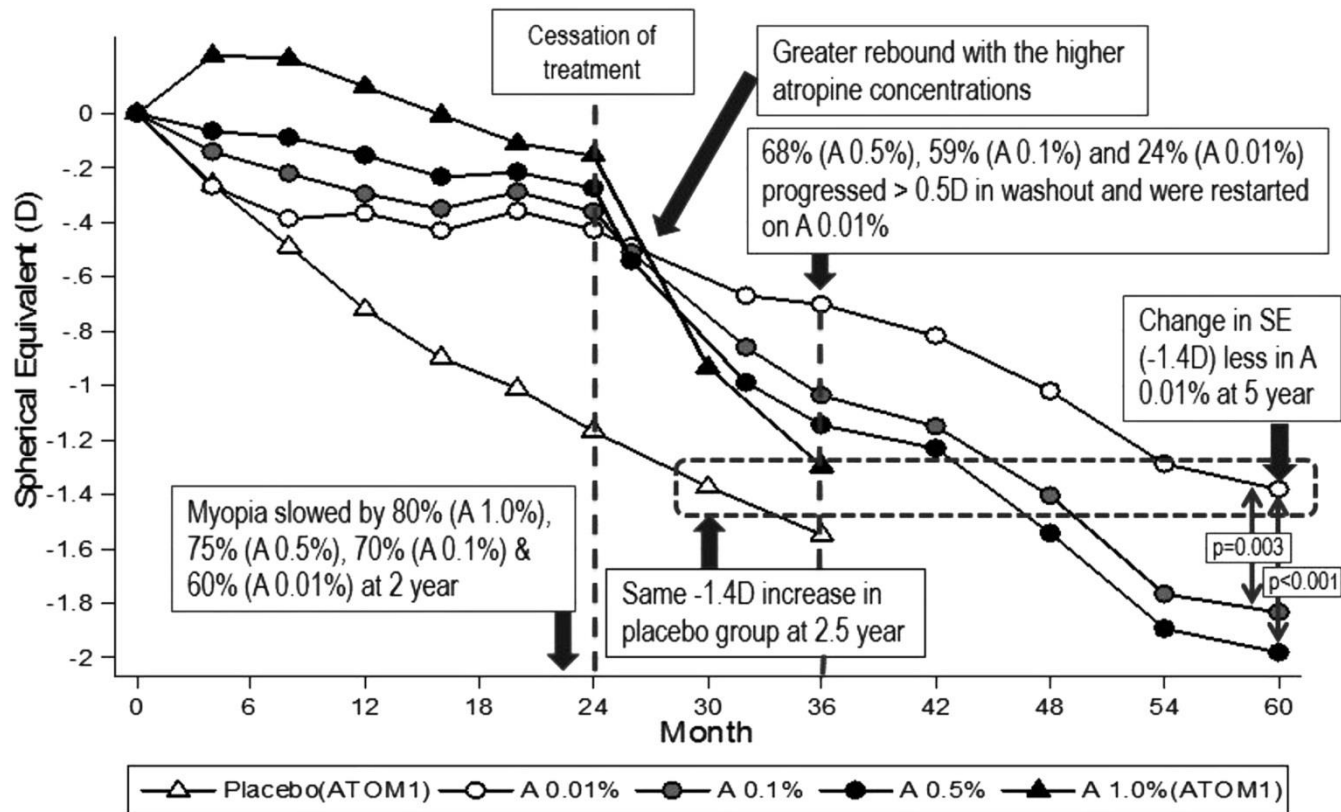
Long term effectiveness

Phase 3 of the ATOM study looked at the effect of recommencing treatment (at 36 months) with 0.01% atropine for a further 24 months (Chia et al, 2016)

Chia A et al (2016) Five-Year Clinical Trial on Atropine for the Treatment of Myopia 2: Myopia Control with Atropine 0.01% Eyedrops . *Ophthalmol*, 123:2; 391-399



Mean change in spherical equivalent over time within different treatment groups (atropine 0.01%, 0.1%, and 0.5%). Error bars represent 1 standard deviation.



Summary of findings from the ATOM1 and ATOM2 studies: change in spherical equivalent (SE). ATOM = Atropine for the Treatment of Myopia; D = diopter.

Over 5 years, atropine 0.01% eyedrops were more effective in slowing myopia progression with less visual side effects compared with higher doses of atropine

The story so far

- Atropine 0.01% eyedrops instilled nightly has been shown to be an effective treatment to prevent (reduce) myopia progression
- Safe; minimal visual side effects
- Study groups mostly Asian with heavily pigmented irides

How about lighter coloured irides?

- 14 university students (18-27 years) received 1 drop atropine 0.01% daily into each eye over 5 days
- Range of physiological, functional and quality of life measures assessed at baseline, day 3 and day 5 (Loughman & Flitcroft, 2017)

Loughman J & Flitcroft DI (2017) The acceptability and visual impact of 0.01% atropine in a Caucasian population. *Br J Ophthalmol*, 100; 1525-1529

- Pupil size increased > 1.0 mm
- Pupillary response significantly more sluggish
- NPC receded slightly (not statistically significant)
- Binocular amplitude of accommodation reduced (not statistically significant)
- WRRT reading speed unchanged
- Distance VA and near VA not significantly affected

Quality of life (n = 14)

4 subjects entirely asymptomatic

8 subjects reported a one-grade increase in their level of difficulty (0 \Rightarrow a little) with one of the 14 vision related tasks

2 subjects reported a one-grade increase in their level of difficulty (0 \Rightarrow a little) with two tasks

Glare was the most commonly reported symptom by six subjects

Conclusions

- Use of atropine 0.01% slows the progression of myopia in children
- Minimal side effects
- Safety over a 5-year period has been demonstrated

The future

- Atropine 0.01% not currently available in multidose or single dose units
- Studies required to assess the efficacy of combination therapies (atropine + contact lenses intervention)

Conclusion

What would be my treatment of choice?

1. Atropine 0.01% together with
 2. Multifocal contact lenses and
 3. Advice on playing in the sun
- (Lagreze WA et al 2017)

Lagreze WA Joachimsen L Scheffel F (2017) Current recommendations for deceleration of myopia progression. *Ophthalmologe*. Jan;114 (1): 24-29.

