Myopia control: the new frontier for optometry

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PLAN

introduction
theory
evidence
other approaches
tips for success
conclusions

Why does myopia matter?

• Common and increasing prevalence
  - 93% of Taiwanese medical students are myopic (Lin et al., 1996)
  - Prevalence of myopia in USA has increased in last 30 years from 25% to 42% (Vitale et al., 2009)
  - 50-55% of UK university students are myopic (Logan et al., 2005)
  - Prevalence of myopia in UK has more than doubled in last 50y (McCullough et al., 2016)

• Significant health impact
  - High myopia (≥-6) increases risk of retinal detachment, myopic macular degeneration, glaucoma, & other conditions
  - "no evidence of a safe threshold level of myopia for any of the known ocular diseases linked to myopia" (Flitcroft, 2012)
  - In the Copenhagen study myopia-related diseases were the most common cause of impaired vision (Hildan et al., 2014)

• Realistic goals of myopia control
  - 33%
    - Person destined to be -6.00 would be -2.50
    - Person destined to be -6.00 would be -4.00
    - Person destined to be -8.00 would be -5.25
  - Reducing the rate of myopia progression by 50% would lead to reduction in frequency of high myopia of over 90% (Brennan, 2012)

• Lecture content always my own
  - I am not a myopia researcher, but a clinician with an interest in helping my myopic patients

DISCLOSURE

• I have received funding from the following bodies for lectures, key opinion leader/product feedback, and research:

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Visual problems

• What is the commonest cause of visual impairment?
  - Myopia is the most common vision disorder and the leading cause of visual impairment worldwide (Tkatchenko et al., 2015)

• Myopia-related diseases were the most common cause of impaired vision (Hildan et al., 2014)
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Realistic goals of myopia control

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• For person destined to be -6.00 (Flitcroft, 2012)
  - No control: -6.00: RD risk 16x MMD risk 40x
  - 50% control: -3.25: RD risk 10x MMD risk 10x
  - 75% control: -1.25: RD risk 2x MMD risk 2x

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Evaluating studies

1a. Systematic review of homogenous RCTs
1b. Individual RCT with good CI
2a. Systematic review of homogenous cohort studies
2b. Individual cohort study
3a. Systematic review of case control studies
3b. Individual case control study
4. Case series
5. Expert opinion

EBP is “the conscientious, explicit and judicious use of current best evidence in making decisions about the care of the individual patient. It means integrating individual clinical expertise with the best available external clinical evidence from systematic research.” (Sackett, 1996)

Does near vision lead to myopia?

- Kepler (1611): “he who is from childhood occupied with study or fine work, speedy becomes accustomed to the vision of near objects, and with the advance of years this increases, so that remote objects are more and more imperfectly seen” (Rosenfield & Gilmartin, 1988)
- “accommodation appears to have a very minor role, if any, in the induction of myopia” (Mulan et al., 2014)
- Near activities not a predictor for myopia (CLEERE study; Zadnik et al., 2015)
- Independent of spending less time outdoors, participants who became likely myopic in later childhood spent more time reading (ALSPAC study; Shah et al., 2017)

Myopia control: vision therapy

- Vision training for myopia control by behavioral optometrists is ineffective (Woods, 1945)
- “Flashes of clear vision” may account from perceived benefit from Bates method (Morgan, 1952)
- Accommodatrac biofeedback ineffective (Koslowe, 1991)
- Biofeedback training ineffective (Angi et al., 1996)
- Perceptual learning no effect on myopia but improves VA (Sumie & McMinn, 2007)

Myopia control: vision therapy

- Slowing of myopia progression with multifocal spectacles

Larger near segment gives greater treatment effect (Bullimore, 2014; Sankaridurg & Holden, 2014)
**Anti-muscarinic drugs**

- Meta-analysis of atropine controlled trials shows 0.5% atropine slows, 1% stops MP (Song et al., 2011)
- Major side effects: photophobia, glare, allergic blepharitis
- “prolonged use clinically inadvisable” (Phillips, 2013)
- Atropine slows MP by 73% (Yu et al., 2011; China)
  - Started with 0.05%, increased to 0.1% if progressed over 0.5D in 6/12
- 0.01% atropine: minimal side effects, almost as effective (Chia et al., 2012)
- “non-accommodative mechanism” (McBrien, 2000)
- Putative action on receptors in sclera
  - 7MX may reduce progression by 66% (Holden et al., 2014)

**Muscarinic Acetylcholine Receptor 2 antibody**

www.abcam.com

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**Refractive error: conventional view**

- **Hypermetropia** (long-sighted)
  - image shell focused behind retina

- **Emmetropia** (normal vision)
  - image shell focused on retina

- **Myopia** (short-sighted)
  - image shell focused in front of retina

**Myopia: the new view**

Patient about to become myopic

- image shell focused on retina at fovea
- image focused behind retina in periphery
- relative peripheral hyperopic defocus - RPHD

The eye grows so the peripheral image is in focus causing myopia at the fovea

Spectacles or contact lenses correct the focus at the fovea, but not the RPHD so myopia progresses

BUT: see Atchison et al. (2015)

*Relative peripheral hyperopia does not predict development and progression of myopia in children*

**How to reduce peripheral hyperopic defocus?**

- RPHD eliminated by orthokeratology (OK) (Ticak & Walline, 2013)
- Large pupil diameters facilitate OK myopia control (Chen et al., 2012)
- Centre-distance multifocal SCL creates peripheral myopic defocus during DV and to lesser extent during NV (Beetsan & Kramer, 2013)
- Proclear [Biofinity] CD design creates RPMD (Wagner et al., 2014; Kang et al, 2013)

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Perceived barriers to fitting CL to kids
- Eyecare practitioners!
- Perceived cost
  - Yet, only about £1 a day
- Some people still think CL will hurt
- Some parents think that the child won’t be able to learn handling
- Fear of microbial keratitis
  - Our job is to allow informed choice
  - Parents accept risks if give children benefits
  - MK occurs 1-2 in 5,000 PA; risk minimised by good hygiene and prompt action
  - With myopia control: risk of sight loss from MK outweighed by reduced risk of myopia-related pathologies
  - Only fit to motivated cases who can be hygienic

Top tips for fitting & tuition
- Address fear of the unknown
- Soft lenses are mostly water
- Let the child handle lenses
- Fitting
  - Don’t put fitting lens directly on cornea
  - Avoid pain
  - If RGP, use anaesthetic at first insertion
- Tuition
  - Aim tuition & literature at child & parent
  - Be positive, realistic, encouraging
  - If your personality is at all impatient/stern, then delegate!
  - At aftercare, right time to be stern!
- Quiz
  1. When do you wear your lenses?
  2. What do you do in the mornings?
  3. What do you do in the evenings?
  4. What are the danger signs?
  5. What do you do if you have a danger sign?
  6. What do you do if the danger sign does not get better over the next few hours?
  7. How often do you replace your lenses?

The quiz
1. When do you wear your lenses?
2. What do you do in the mornings?
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6. What do you do if the danger sign does not get better over the next few hours?
7. How often do you replace your lenses?
Caveats
- Need more RCTs
  - But myopia control effective "on balance of probabilities" and need to start young
- Persistence of treatment effect
  - Unclear whether the treatment effect is sustained
  - May be rebound effect when stop intervention
  - Perhaps unlikely with optical interventions & can keep in MF CL until myopia likely to be stable
- Check for DV blur – max add for good DV
- Axial length changes correlated with myopia changes ($r^2 = 65\%$)
- Followers of a theory tend to ignore other theories
  - If myopia wasn’t multifactorial, then we would have solved it by now!

Conclusions: myopia control in European children
- If NV esophoria or high accommodative lag, recommend multifocals
  - MF glasses (E-seg) likely to reduce progression rate by 30-40%  
  - MF CL may reduce progression by up to 70%  
  - Aim to eliminate esophoria; typical add +2.00, CD
- If not esophoric and normal lag, effect reduced
  - MF glasses likely to reduce progression by only 15%
  - MF CL success unclear, perhaps 36-60% if perform like dual focus
- OK slows myopia progression by 32-63%
- Also encourage kids to go outdoors

Dr Optometry
- In 2008 the Institute of Optometry launched a Doctor of Optometry degree in collaboration with London South Bank University
- 5 year part time professional doctorate
  - Year 1 has 13 taught days & 2 assignments
  - Year 2 has 8 taught days & 2 assignments
  - Years 3-5 are supervised doctoral research
  - "the ultimate higher qualification for UK optometrists"

Eyestrain from Computers?
Are you 16-40 and have eyestrain or headache from computers?
Our research may improve comfort, accuracy & productivity
- In our study, you will be given a free detailed eye examination to find causes of eyestrain
- We will provide a report describing solutions
- We will tell you whether you are eligible for a clinical trial later in the year of new glasses for computer eyestrain. If suitable, you would receive these free of charge.

For more information, please contact:
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Please pass this message to other computer users
We find comfort among those who agree with us – growth among those who don’t.

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