Review of myopia control options to reduce myopia progression in children

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Myopia-Controlling Methods to Reduce Myopic Progression Rates in Young Children: A Review

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Overview

The role of:
1. Light
2. Optical interventions
3. Pharmaceutical agents
Background

- Myopia can be corrected by spectacles, contact lenses or refractive surgery.
- Highly myopic eyes have an increased risk of developing eye diseases, such as glaucoma, retinal detachment and myopic maculopathy.
- Myopia has a genetic component and is also influenced by environmental factors.
Overview

The role of:
1. Light
2. Optical interventions
3. Pharmaceutical agents
Light: Protective effect of playing outdoors

Rose et al., 2008.

Odds ratio

High Moderate Near-work Low

Low Moderate High


[Diagram showing odds ratios for different levels of light exposure and near-work.]
Light: Axial growth in the winter months

Light: Protective effect of high ambient lighting

- In infant rhesus monkeys, high ambient lighting levels retard the development of form-deprivation myopia.
- Higher ambient lighting levels (in classrooms) reduce myopia onset in Chinese school children.

Light: Vitamin D

• Vitamin D levels were not different in a cohort of 22 subjects (14 myopes).
• In a large population (n=2038) of Korean teenagers, high myopia was associated with low levels of vitamin D … indicating the possible involvement of sunlight?

Overview

The role of:

1. Light
2. Optical interventions
3. Pharmaceutical agents
Optical interventions: Spectacles

- Under correction
- Progressive addition lenses (PALs)
- Executive bifocals
Optical intervention: Under correction

• Hypothesis: myopic defocus reduces accommodative effort

• Studies showed that under correction worsens myopia

• Children who are under-corrected might spend the majority of their time with near work.

Chung et al. (2002) Vis Res. 42(22): 2555-9
Vasudevan et al. (2014) J Optom 7(3): 147-52
Optical intervention: PALs

• Hypothesis: reduced accommodative demand at near
• Low efficacy: statistically significant, but with no clinical relevance
• However, PALs cause a myopic shift in peripheral defocus. Superior myopic defocus was associated with less central myopia progression.

Bernsten et al. (2013) Invest Ophthalmol Vis Sci. 54(8): 5761-70
Optical intervention: Executive bifocals with and without prism

- Hypothesis: Reduces accommodative demand at near and leads to myopic defocus at superior retina
- Good efficacy: currently best spectacle option available
- Example: Essilor Myopilux Max

Chang et al. (2014) JAMA Ophthalmol 132(3): 258-64
Optical intervention: Peripheral defocus correction

- Hypothesis: Reduce peripheral hyperopic defocus
- Small effects and in subgroups only
- Examples
  - Essilor: Myopilux Plus
  - Zeiss: Myovision
- Major limiting factor: eye movements behind lens does not provide a ‘consistent’ stimulus

Sankaridurg et al. (2010) Optom Vis Sci. 87(9): 631-41
Optical intervention: Contact lenses

• Options
  – Multifocal contact lenses
  – Orthokeratology (Ortho-K)
Optical intervention: Multifocal contact lenses

Optical intervention: Ortho-K

• Hypothesis: Control myopia by flattening the corneal profile to result in peripheral defocus control
• Significant effects in refractive error and axial length growth

Overview

The role of:
1. Light
2. Optical interventions
3. Pharmaceutical agents
Pharmaceutical intervention

- Atropine
- Cocoa beans
Pharmaceutical intervention: Atropine

Pharmaceutical intervention: Cacao

- 7-methylxanthine (7-MX)
- Occurs naturally in the cacao fruit (cocoa beans)
- 7-MX increases the content of collagen in the sclera
- Therefore hypothesised to act against the progression of myopia
- Metabolite of caffeine and theobromine
- Does not cross the blood brain barrier (unlike coffee) – no stimulatory effect
- Very low toxicity
- A drug has been approved on a limited basis in Denmark

Summary

• Under correction is not advocated.
• Spectacles: Limited myopia control except for executive bifocals.
• Orthokeratology is a good choice.
• The intake of Cacao seems promising.