

The Complex Nature of Myopia Control Research: Not so black and white

The prevalence of myopia is growing worldwide, with consequences that include decreased quality of life and economic costs to patients as well as an increased risk for developing serious eye pathologies. Efforts to control the progression of myopia date back to the mid-1800s, and since then have been constrained by complexity, uncertainty and debate, contributing to a lack of consensus as to which path is most effective.

Consider the following:

We still don't know what causes myopia. There is no conclusive evidence that myopia is linked to accommodation,¹⁻³ although a number of interventions are based on this assumption. The role of environmental and genetic factors need further investigation.^{2,4-6}

We don't agree on what makes results clinically significant. How many diopters' shift in myopia constitutes a clinically significant difference, warranting a change in clinical practice?⁷

The benefits of research and interventions should be balanced with ethics and safety guidelines. At what point is it okay to expose myopic children to side effects such as pupil dilation and microbial keratitis?^{3,7}

Clinical trials testing myopia control interventions have been inconsistent. Areas of contention include the use of appropriate controls and sample size, effective masking and consistent randomization. There is also inherent bias in studies comparing discernable interventions such as spectacles and contact lenses.^{5, 7,8}

We don't know whether refractive error or axial growth is the best measure of myopic progression. This relatively recent question obscures comparisons between studies, complicating efforts to understand clinical relevance.⁸

The interventions

Arguably, clinically meaningful results have yet to be reported for myopia control research, particularly with respect to longer term effects.^{1,7-8} The following list outlines the major interventions explored to date.

Bifocal or progressive spectacles: Bifocal and progressive spectacles have been used with children as a means of reducing the need for accommodation. While there is some evidence of a positive effect on myopia, the research has for the most part failed to show a significant or clinically meaningful effect.^{1,3-4,8}

Peripheral retinal defocus: In animal models, altering the peripheral power of a corrective lens affects axial length.^{3,10-11} Contact lenses designed to induce peripheral hyperopia in myopic children have shown promise in slowing the progression of myopia,¹²⁻¹³ but the magnitude and permanence of this effect remains unclear.⁴

Orthokeratology: Overnight wear of reverse geometry contact lenses can correct low levels of myopia via corneal flattening.¹⁴⁻¹⁵ Recent work has shown that the use of this technique can also slow the progression of myopia in children by slowing axial elongation,¹⁶ but the mechanism remains unclear at this time.

Undercorrection: The rationale for undercorrecting myopia is unclear, and the method is not supported by research.^{3-4,8} This strategy is *not* recommended.

Pharmaceuticals: Atropine has been reported to be the most clinically effective intervention,^{1,8,17} although the exact mechanism and optimum dosage both remain unclear.¹⁷ A low dosage may be most beneficial.¹⁸ Its use is linked to serious short- and long-term side effects^{1,8} and so should be limited to children at high risk for high myopia and associated complications.¹

Time outdoors: There is some evidence that outdoor activity may prevent or slow the development of myopia, although the exact mechanism of this effect is unclear. It may be related to reduced accommodative response, or possibly light quality and subsequent light-related release of retinal dopamine, which may be critical to regulating ocular growth.⁵⁻⁶ A possible connection between Vitamin D and myopia requires further study.¹⁹

Visual training (with or without biofeedback): This approach suggests that myopia can be reduced by training patients to activate and relax their accommodation. Research suggests that the positive effects of this intervention are learned and not due to a reduction in myopia.^{3,20}

Additional reading

We found a number of resources helpful in developing this research brief:

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