

Myopia: A Global Health Challenge



MODERATED SESSION



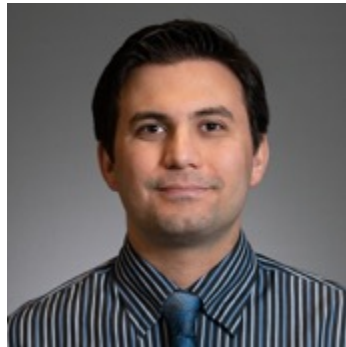
Session Moderator:

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Professor Emeritus

Prevent Blindness Board Member

National Center for Children's Vision and Eye Health
at Prevent Blindness Advisory Committee Co-Chair



Bobeck S. Modjtahedi, MD

Southern California Permanente Medical Group



**Fuensanta A. Vera-Diaz, OD, PhD,
FAAO**

New England College of Optometry



Myopia: A Global Health Challenge

Sandra S Block, OD, M Ed, MPH

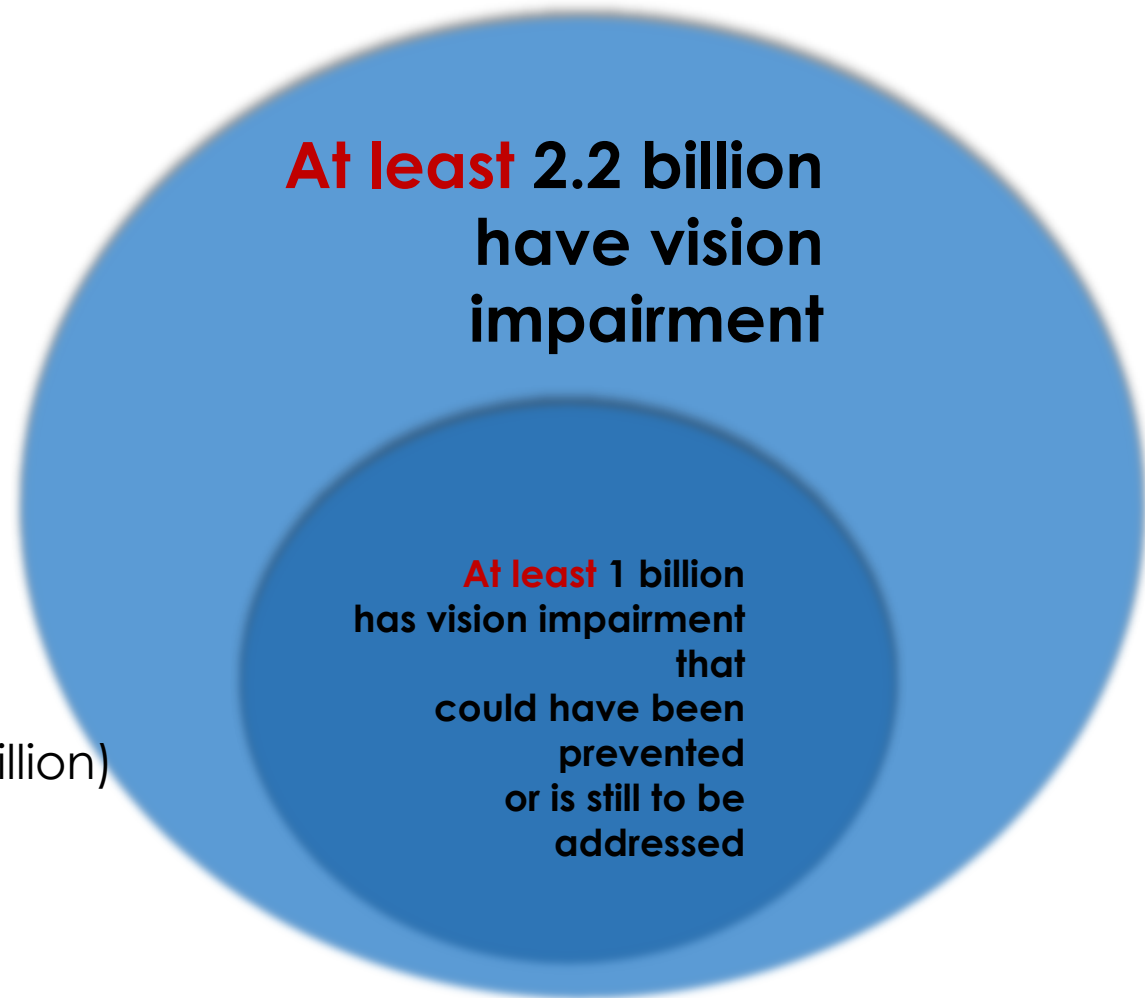
Co-Chair, National Center for Children's
Vision and Eye Health

Professor Emeritus, Illinois College of
Optometry

Myopia: A Global Health Challenge

- Global Magnitude of Visual Impairment

- Unaddressed refractive error (123.7 million)
- Unaddressed presbyopia (826 million)



What is myopia?

- Also referred to as near-sightedness or short-sightedness
- Most common type of refractive error
- Causes distance vision to be blurry such as looking at the board, looking across the street, driving
- Begins to emerge in childhood and increases with age primarily through the teen years

Why are we concerned?

- Causes a significant cost to society – estimated to be US \$250 billion in 2015
- Leads to significant pathological findings if unchecked.

Have Risk Factors Been Identified?

- Genetic links
 - Increase in risk of developing myopia with one parent myopic
 - Risk increases with both parents myopic
 - Ethnicity – East Asian increases risk of developing
- Environmental
 - Lack of exposure to outdoors
 - Increase in device use during COVID-19 pandemic in early childhood

Can we do something about this impending problem?

- Research has been published and more work is currently being pursued to identify how to control the progression of myopia.
- Our panelists will talk about some of the issues related to early identification of who is at risk, what can be done to prevent or slow the progression and what are the complications when the myopia continues on uncontrolled.

Panelists

Bobek Modjtahedi, MD

Kaiser Permanente Southern California

American Academy of Ophthalmology Task Force on Myopia

He will discuss the long-term impact of myopia on the patient across the life span.

Panelists

Fuensanta A. Vera-Diaz, OD, PhD, FAAO

Associate Professor of Optometry, New England College of Optometry

Clinical researcher focused on myopia

She will present on treatments and approaches to population level interventions for myopia.

A Q & A discussion will follow after their short presentations. Please enter your questions in the Q & A section.



Prevent Blindness

Focus on Eye Health
National Summit



Our Changing Vision

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Long-term impacts of myopia

Bobek S. Modjtahedi, MD

Director, Eye Monitoring Center

Co-Chair, Kaiser Permanente Center for Ophthalmology Research and Innovation

Director, Electrophysiology and Retinal Degeneration Service

Southern California Permanente Medical Group/Kaiser Permanente Southern California

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Looking beyond glasses: long-term consequences of myopia

- Myopia is associated with:
 - Psychosocial stress
 - Economic cost
 - Uncorrectable visual impairment



AMERICAN ACADEMY
OF OPHTHALMOLOGY®



Reducing the Global Burden of Myopia by Delaying the Onset of Myopia and Reducing Myopic Progression in Children

The Academy's Task Force on Myopia

Bobeck S. Modjtahedi, MD,^{1,2} Richard L. Abbott, MD,³ Donald S. Fong, MD,^{1,2} Flora Lum, MD,⁴
Donald Tan, MD,⁵ on behalf of the Task Force on Myopia

In 2019, the American Academy of Ophthalmology (AAO) created the Task Force on Myopia in recognition of the substantial global increases in myopia prevalence and its associated complications. The Task Force, led by Richard L. Abbott, MD, and Donald Tan, MD, comprised recognized experts in myopia prevention and treatment, public health experts from around the world, and organization representatives from the American Academy of Family Physicians, American Academy of Optometry, and American Academy of Pediatrics. The Academy's Board of Trustees believes that myopia is a high-priority cause of visual impairment, warranting a timely evaluation and synthesis of the scientific literature and formulation of an action plan to address the issue from different perspectives. This includes education of physicians and other health care providers, patients and their families, schools, and local and national public health agencies; defining health policies to ameliorate patients' access to appropriate therapy and to promote effective public health interventions; and fostering promising avenues of research. *Ophthalmology* 2021;128:816-826 © 2020 by the American Academy of Ophthalmology



Supplemental material available at www.aaojournal.org.

Psychosocial impact of myopia

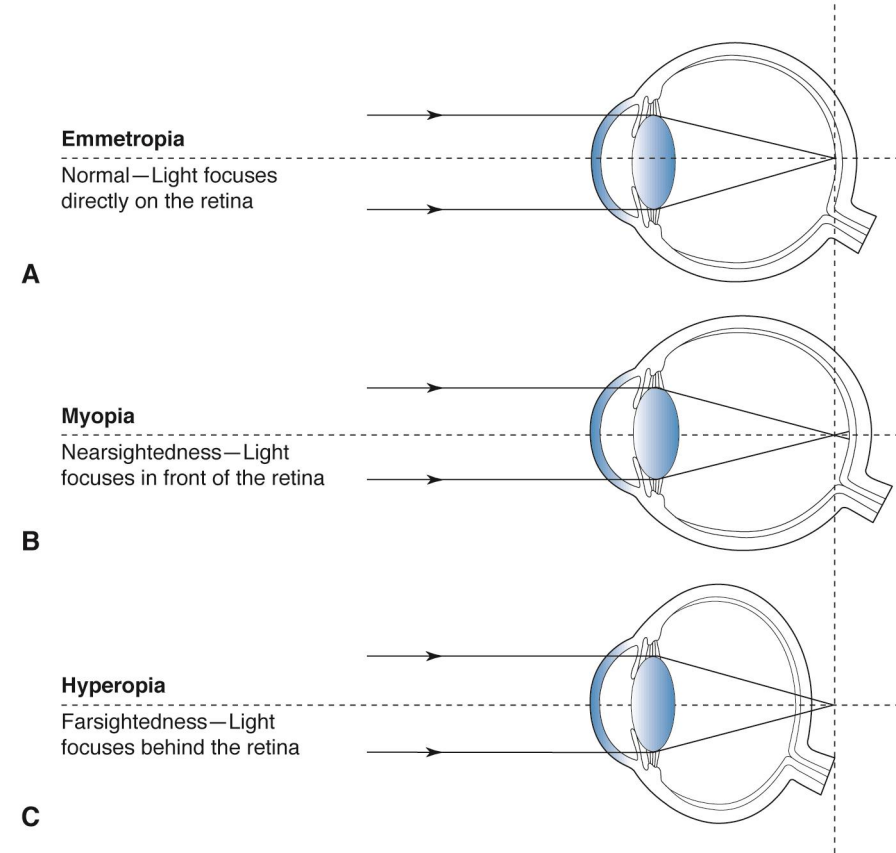
- Diminished quality of life ⁽¹⁻⁴⁾
 - Direct and indirect costs
 - Cosmesis
 - Difficulty with playing sports
 - Limitations in employment opportunities
 - Care giver burden/stress

Long-term risk of vision loss

- Myopia increases the risk of uncorrectable visual impairment, especially with advancing age. ⁽⁵⁾
 - By age 75 uncorrectable visual impairment is seen in 3.8% of myopic patients (0.50 to –6.00 D myopia) and 39% patients with high myopia (–6.00 D or more myopia).
 - By 2055 it is estimated that uncorrectable visual impairment from myopia will increase 7-13x in high-risk areas.

Risks of myopia

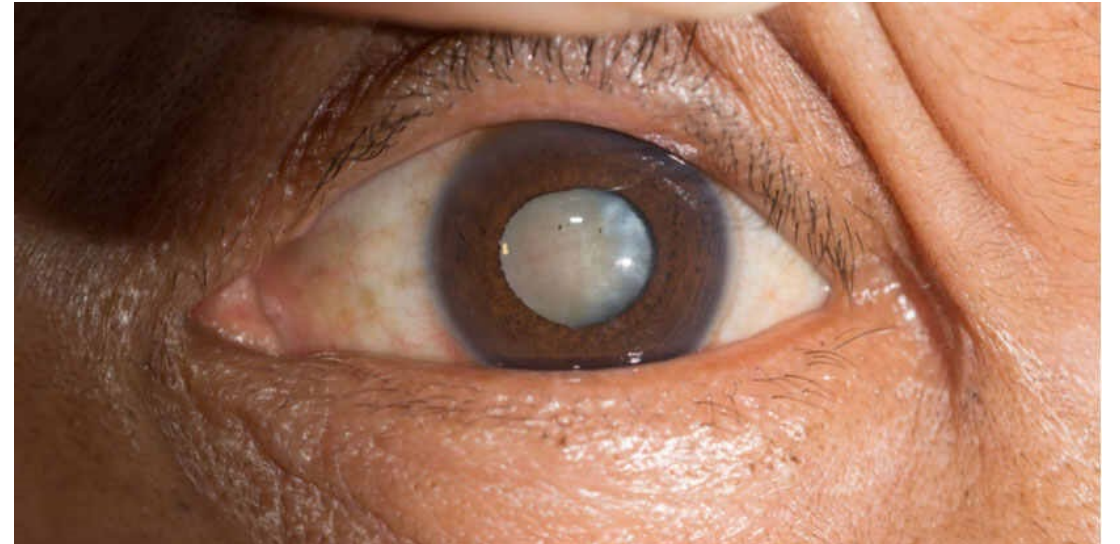
- Cataract
- Glaucoma
- Retinal detachment
- Staphyloma
- Myopic macular degeneration
- Myopic choroidal neovascularization.



<https://www.aao.org/image/refractive-errors-2>

Cataract ⁽⁶⁾

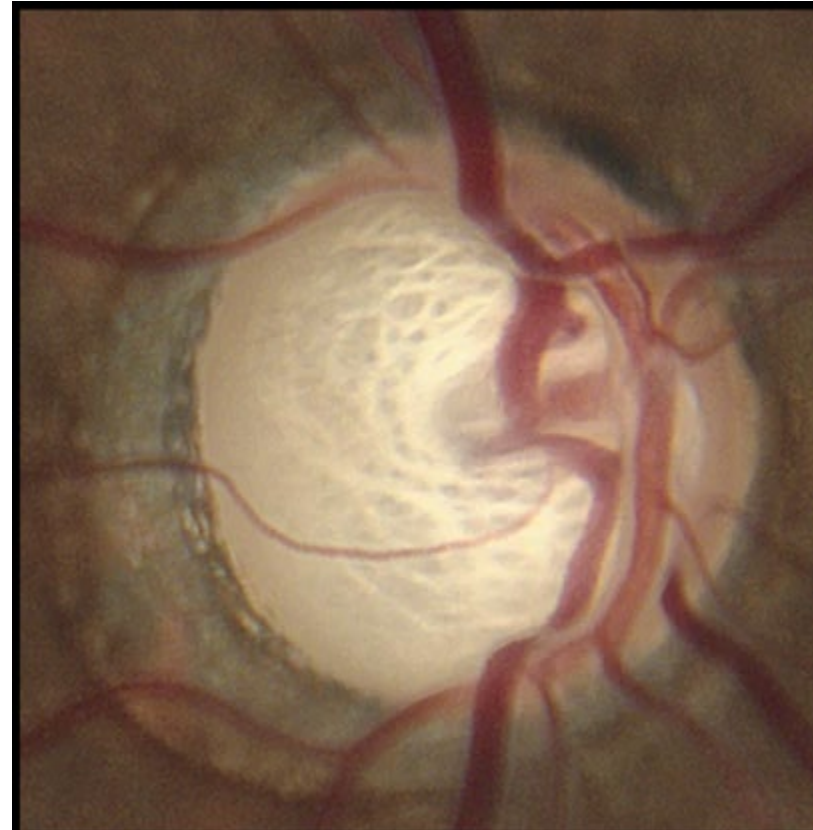
- Nuclear cataract more likely in those with high myopia [Odds ratio (OR) = 3.01]
- Posterior subcapsular cataract associated with low (OR=1.86) and high myopia (OR=7.80).
- Cataract surgery significantly associated with low (OR=2.54), moderate (OR=2.61), and high myopia (OR=4.81)



<https://www.aao.org/eye-health/diseases/what-are-cataracts>

Glaucoma

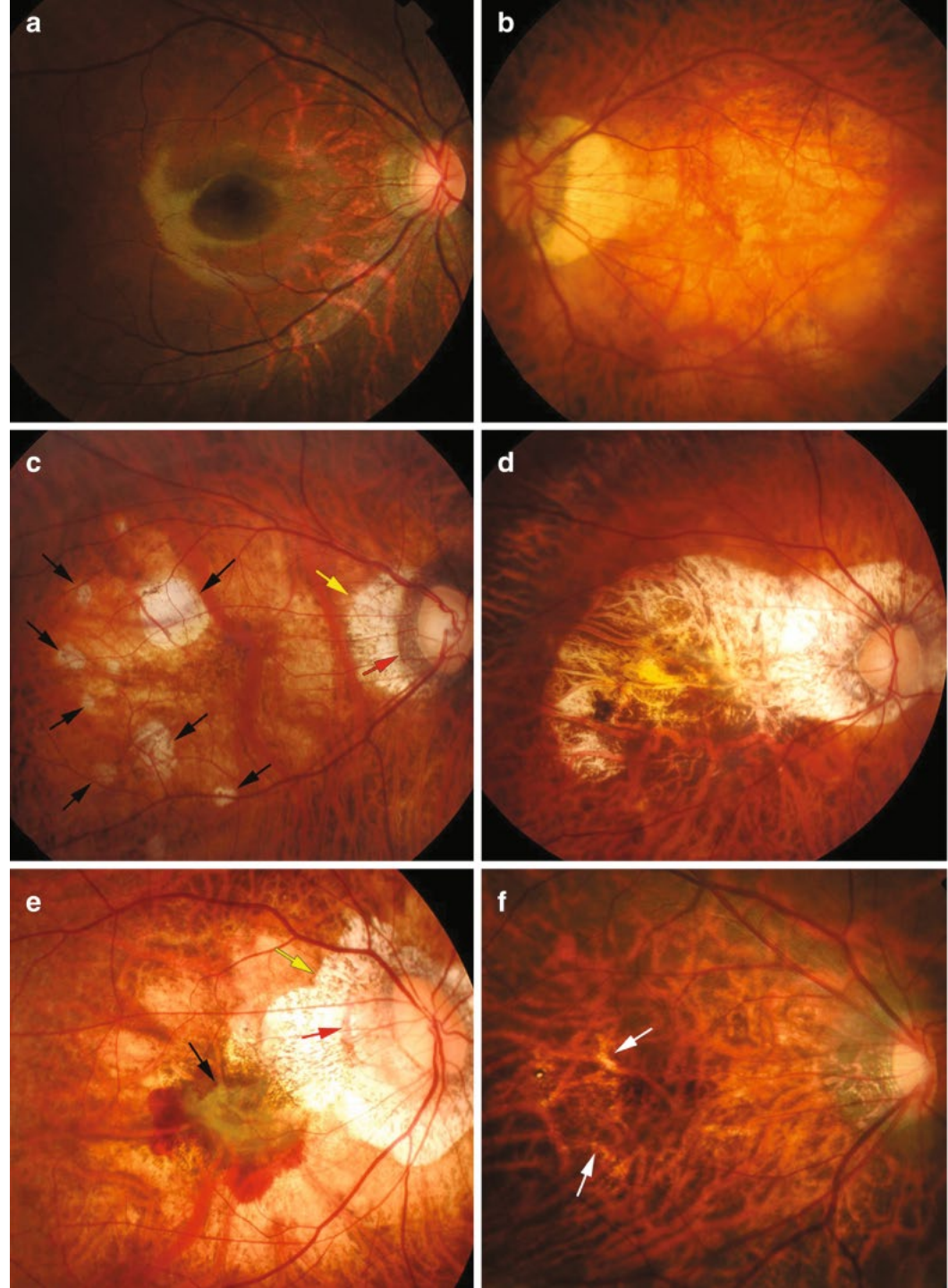
- Myopia associated with a higher incidence of glaucoma (OR=2.3)⁷
 - OR=3.3 for those with moderate-to-high myopia



<https://www.aao.org/topic-detail/primary-openangle-glaucoma--europe>

Myopic maculopathy

- Thinning and tissue loss
 - 1-mm increase in axial length → 10.84% higher risk of pathologic myopic retinopathy → 7.35% higher risk of low vision⁽⁸⁾

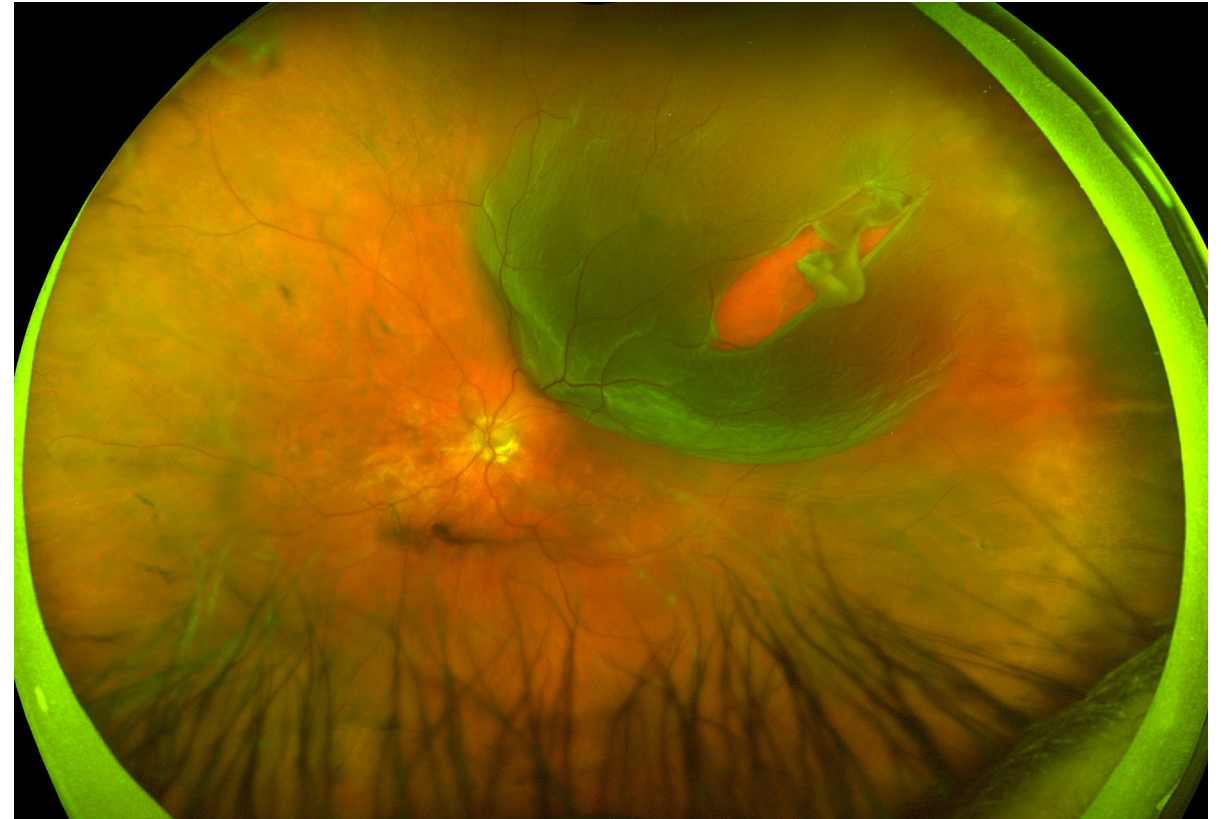


Pathologic myopia

- 10 million individuals are visually impaired and 3.3 million are blind due to myopic macular degeneration. ⁽⁹⁾
 - By 2050 it is estimated 55.7 million will be visually impaired and 18.5 million will be blind.
- 12.2% -31.25% of cases of low vision in East Asia ⁽¹⁰⁻¹⁴⁾.
 - Wu et al found pathologic myopia was the most common cause of blindness in China. ⁽¹⁵⁾
- 6-9.1% of cases blindness in predominantly White Countries ^(14, 16-19)
 - Most common cause of visual impairment (25%) in Dutch patients < 75 years of age. ⁽¹⁶⁾
- Third-most common cause of blindness in the Los Angeles Latino Eye Study (12.5%)⁽²⁰⁾

Retinal detachment (RD)

- 4x higher risk of RD in those who are – 1.00 to –3.00 D²¹
- 10x higher risk in those who more than 3.00 D of myopia²¹



<https://recognizingpathology.optos.com/retinal-detachments/>

Socioeconomic impact of myopia²²

- Direct costs of refractive correction
- Indirect costs from lost economic opportunity
- Infrastructure cost for caring for myopic patient
 - Training eye care providers, building clinics, etc
- \$244 billion in lost economic opportunity globally from uncorrected error²³
 - \$6 billion in lost productivity from myopic macular degeneration
- 5-year investment of \$20 billion would address visual impairment from uncorrected refractive error²³

Long-term impacts on myopia

- Patient level
 - Individual costs
 - Psychosocial stressors
 - Higher risk of uncorrectable visual impairment
- Population level
 - Costs associated with screening and treatment of myopia
 - Costs associated with secondary sequelae
 - Lost economic opportunity for patients and care givers

Acknowledgements

- American Academy of Ophthalmology Task Force on Myopia
- Eye Monitoring Program, Kaiser Permanente Southern California
- Myopia Control Program, Kaiser Permanente Southern California

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Evidence-Based Myopia Management

Fuensanta A. Vera-Diaz, OD, PhD, FAAO

Focus on Eye Health Summit: **Our Changing Vision**

July 15, 2021

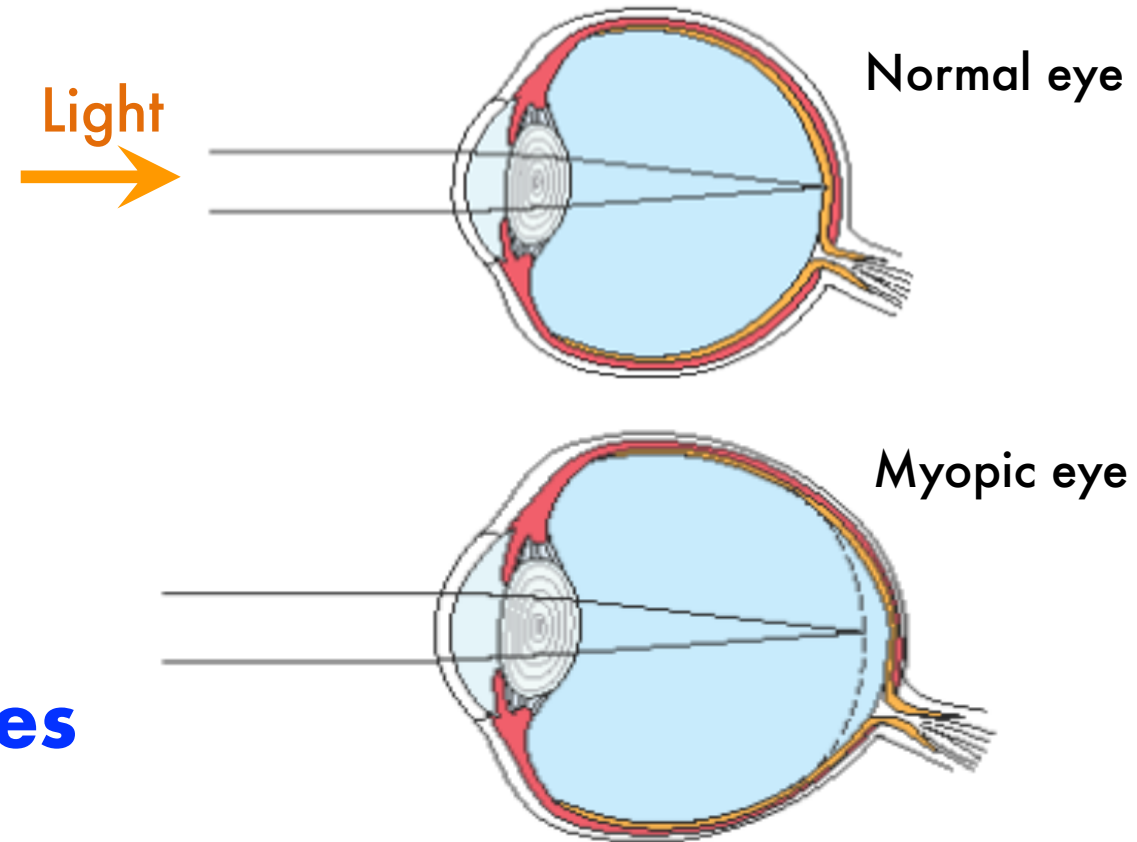


Significance of Myopia

Vera-Diaz, Encyclopedia of the Eye, 2010

Myopia = excessive elongation
of the eye

Vision-threatening consequences
of this excessive elongation



Ultimate Goal: To Prevent Myopia

Risk-factors for Myopia:

- Decreased time outdoors and increased time doing near work
- Family history
- Racial origin
- Refractive error at age 6 years

What can we do to Prevent Myopia?

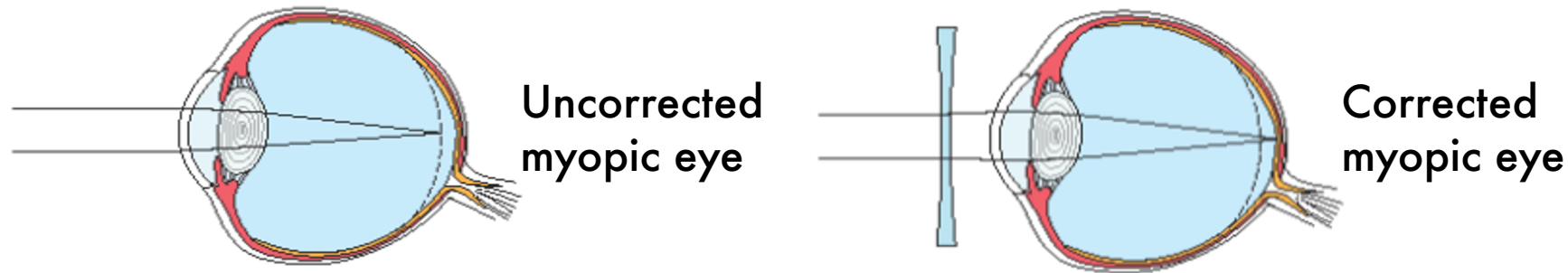
Therapies?

- Increase time **OUTDOORS** and other environmental considerations

Correction vs Control of Myopia

- **Correction:** bring the focal point to the retina with (-) lenses

With regular glasses, contacts, refractive surgery...



- **Control:** slow down or halt the progression of myopia
(higher myopia = higher risk of potentially blinding diseases)

Currently Available **Myopia Control** Treatments

- **Optical**

- Bifocal/Progressive glasses; newer Peripheral Designs glasses
- Multizone contact lenses
- Orthokeratology

- **Pharmacological** – Low dose Atropine

Eyeglasses for Myopia Control

- **Bifocals or progressives**

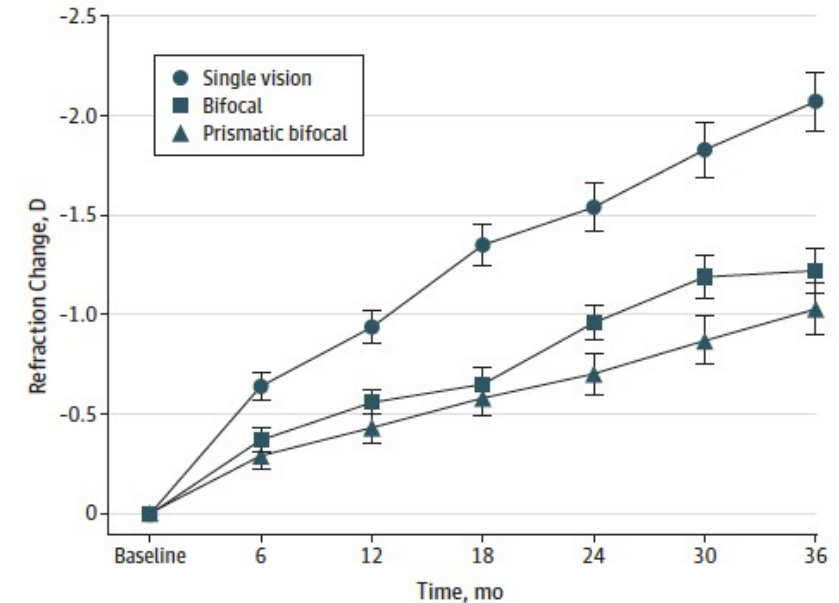
Near **Adds** used for decades to treat myopia

E.g., COMET study, Cheng et al executives (largest effect)

- **Peripheral designs**

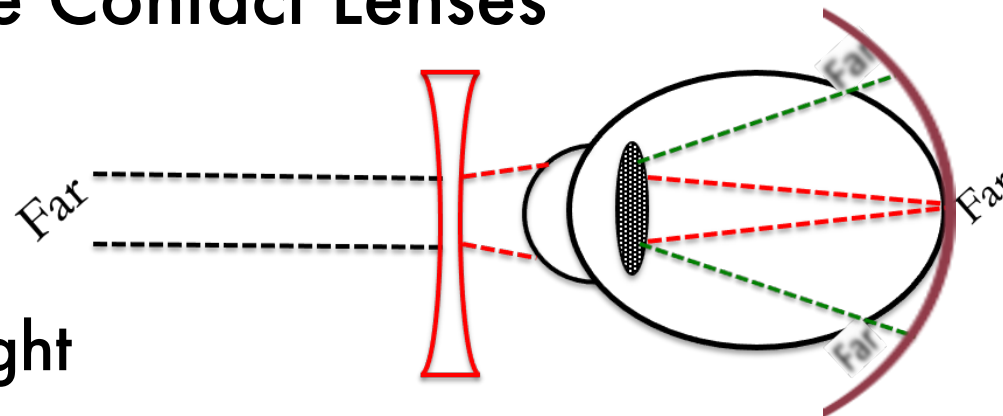
- Peripheral defocus - MyoSmart (Hoya, DIMS)
- Peripheral scattering - CYPRESS (Sightglass, DOT)
- Peripheral asphericity - Stellest (Essilor, HALT)

Cheng et al, 2014

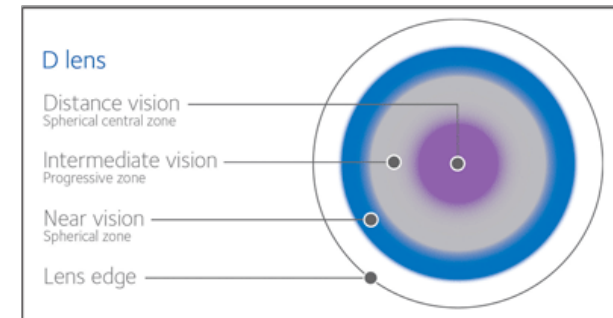


Contact Lenses for Myopia Control

- Multizone Contact Lenses

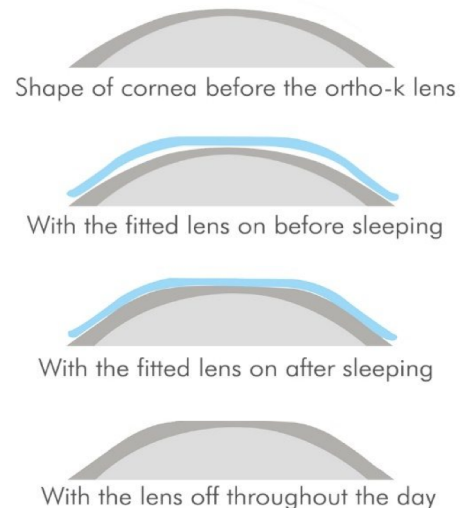


E.g., MiSight



- Orthokeratology

E.g., Ability



Pharmacological Treatments for Myopia Control

- **Compounds?**

M_1 selective antagonist Pirenzepine, α -adrenergic agonist Brimonidine, selective agonist of prostaglandin Latanoprost, adenosine receptor antagonist 7-methylxanthine, bilberry extract, carotenoid Crocetin...

- **Low dose atropine eye drops**

- More effective in controlling Diopters of myopia than ocular elongation?
- 0.01%, 0.025%, 0.05%?
- Nonselective muscarinic antagonist — mechanism?

To More Effectively Prevent and Control Myopia...

- We need to understand its **Mechanism(s)**
- We know: **Etiology is primarily environmental**
 - Genetic predisposition, but only account <10% variability
 - Changes in society: urbanization, schooling, increased near work (screens)
- We don't know: **Exact Mechanism: How?**
 - **Visual stimulation** regulates retinal neurotransmitters and growth factors → scleral remodeling and axial elongation

Conclusions

- Myopia is a highly significant problem (not just a refractive error)
- **There is something we can do about it!**
- Current treatments not always efficacious, more research needed...

BUT, slowing progression even by just 1 D reduces risk of:

- Myopic maculopathy by 40%
- Retinal detachment by 30%
- Primary open angle glaucoma by 20%

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Thank you.

Questions?

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