Myopia Control: Implementing Effective Treatment Options in Clinical Practice

Katherine Bickle, OD MS

March 6, 2016

Etiology of Myopia

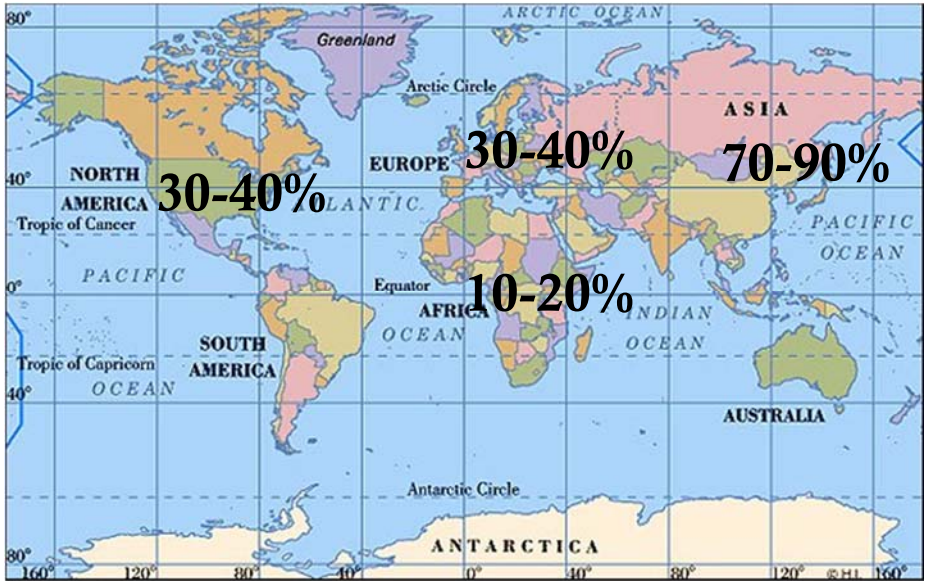
Genetics

Environmental

Myopia

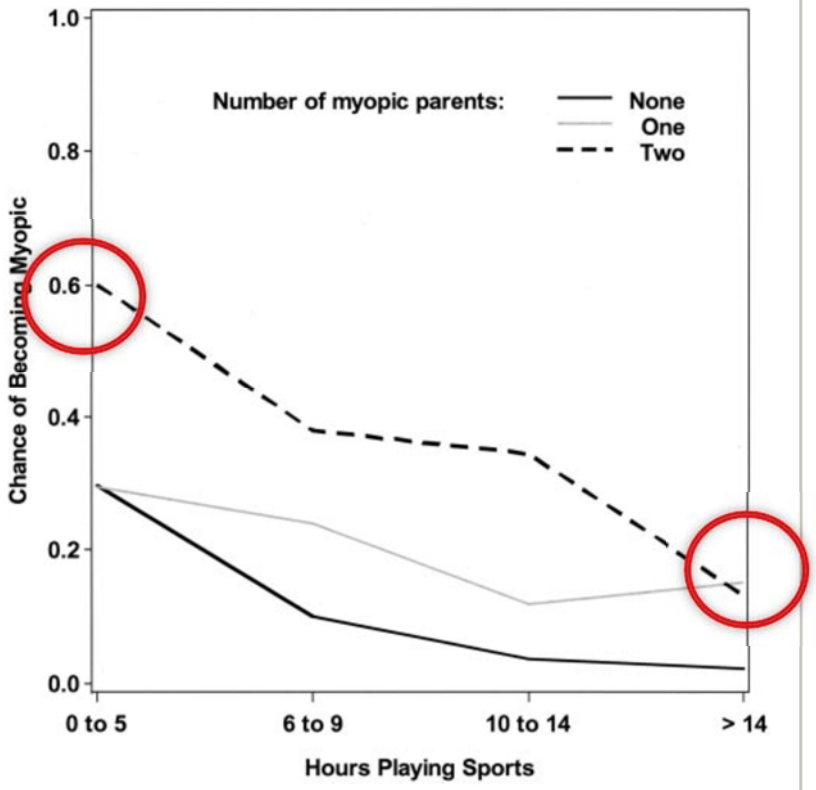
The Prevalence of Myopia

- Africa – 10-20%
- United States – 30-40%
- Europe – 30-40%
- Asia – 70-90%
  - Up to 20% are highly myopic



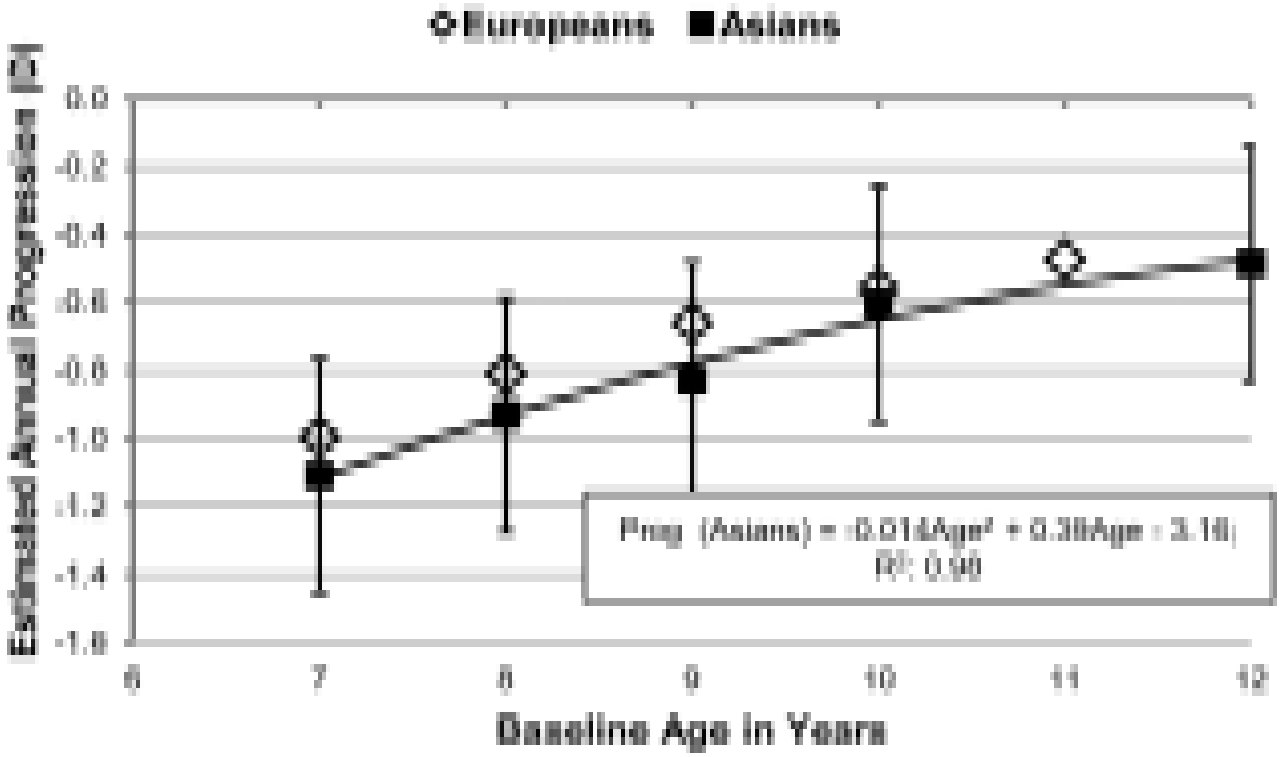
Potential Factors Impacting Myopia Development

- **Refractive Error**
  - Parents' refractive error
    - 1 myopic parent: 2.17x risk
    - 2 myopic parents: 5.40 x risk
  - Patient's current refractive error
    - +0.75 D or less hyperopia with young school aged children
- **Time spent outdoors**
  - Nonmyopes: 11.65 ± 6.97 hours/week
  - Future myopes: 7.98 ± 6.54 hours/week



Jones et al., 2007, Zadnik et al., 1999

Rate of Myopia Progression



*Data represents a summary of 20 compiled published journal articles

Donovan et al., 2012

Public Health Considerations

Myopia increases the risk for:

- Retinal holes and tears
- Glaucoma
- Cataracts
- Retinal and vitreal detachments
- Lattice degeneration
- Lacquer cracks
- Myopic macular degeneration

Saw, et al., 2005

Clinically Significant

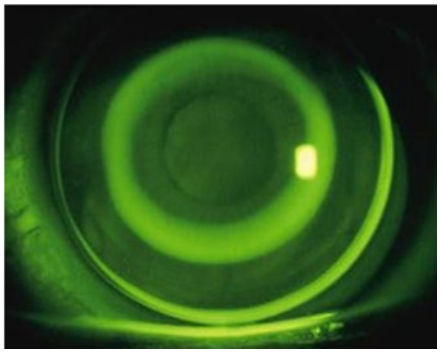
- An 8-year-old patient presents with a refractive error of -1.00 DS OU

Percentage of myopic reduction	Patient's final refractive error
0%	-5.00 D
25%	-4.00 D
50%	-3.00 D
75%	-2.00 D
100%	-1.00 D

*Estimate myopia progression of -0.50 D per year from ages 8-16

Myopia Control Treatment Options

- **Topical Agents**
  - Atropine
  - Pirenzepine
- **Spectacles**
  - Bifocals
  - PAL's
  - Undercorrection
- **Contact Lenses**
  - Alignment fit GP's
  - Corneal reshaping lenses
  - Soft multifocal lenses



Myopia Control Treatment Options

- **Least effective**
  - Undercorrection (-16 to -22%)
  - Gas permeable contact lenses (-5 to -8%)
- **Moderately effective**
  - Soft bifocal contact lenses (34 to 79%)
  - Corneal reshaping contact lenses (36 to 58%)
- **Most effective**
  - Atropine (76 to 96%)

% = reflects the percentage of reduction of myopia progression when compared to a control group

Peripheral Optical Profile

Myope corrected with spectacles or single vision soft contact lenses

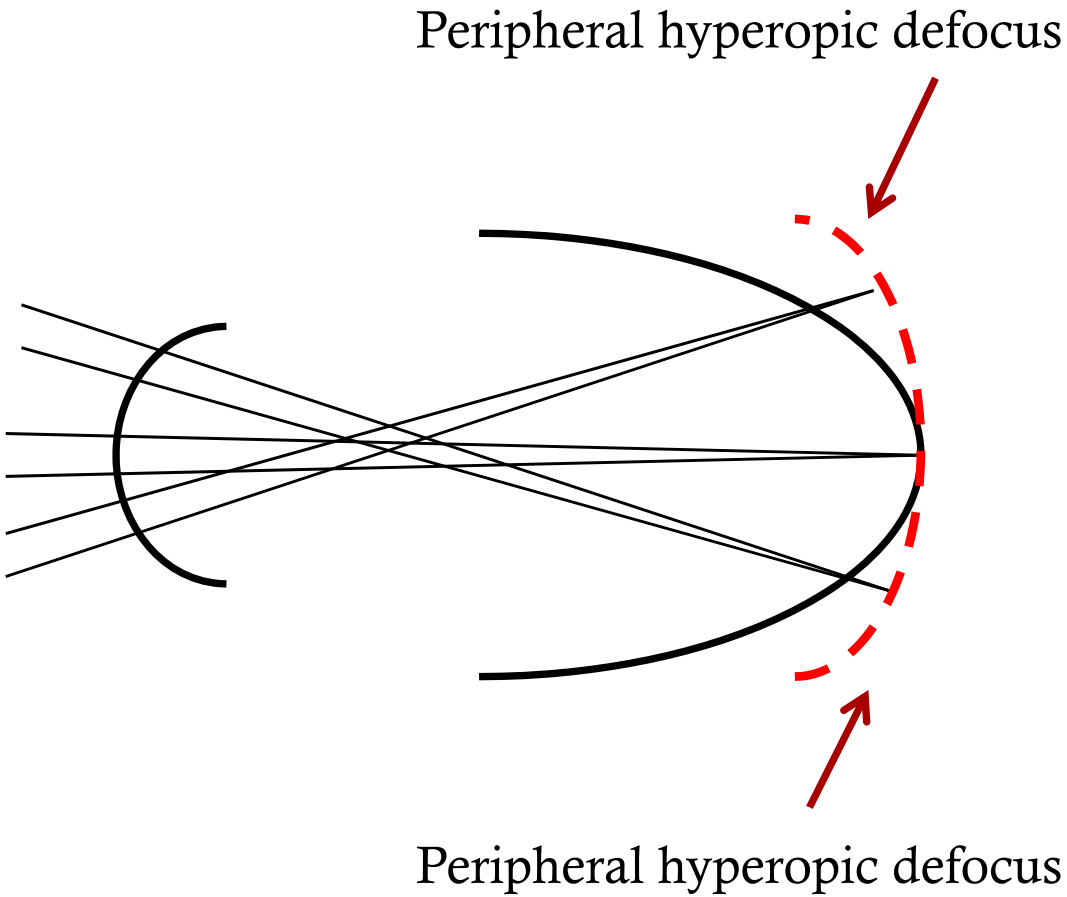
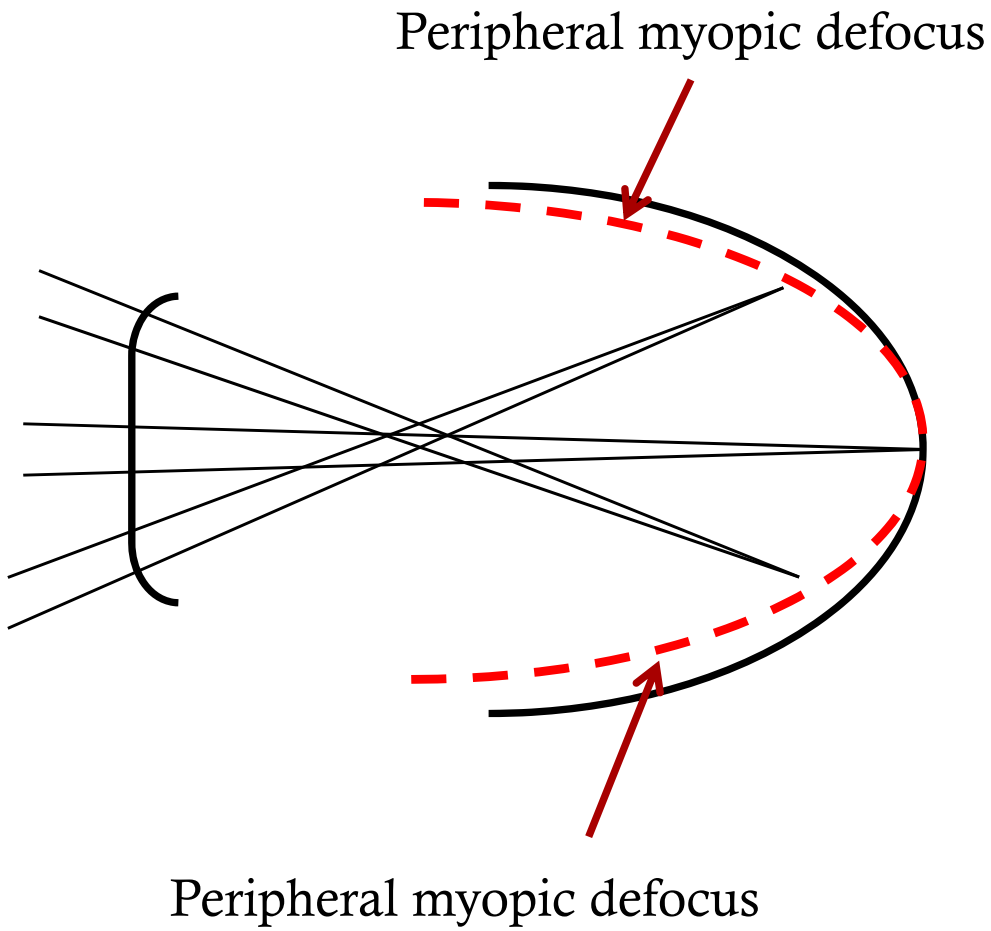


Image obtained from Dr. Jeffrey J. Walline

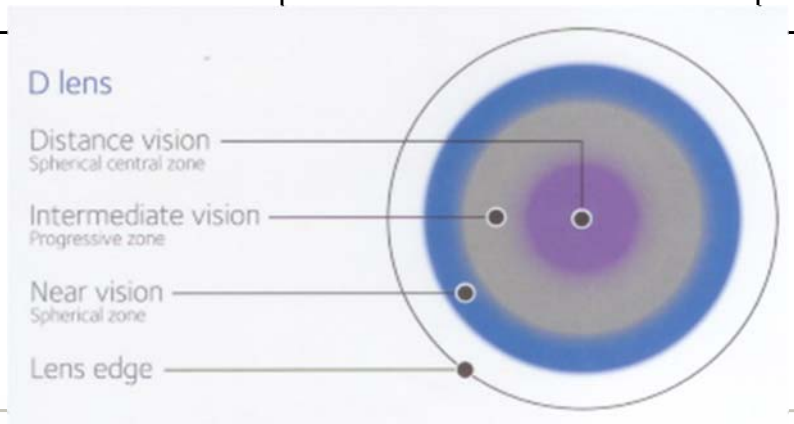
Peripheral Myopic Defocus

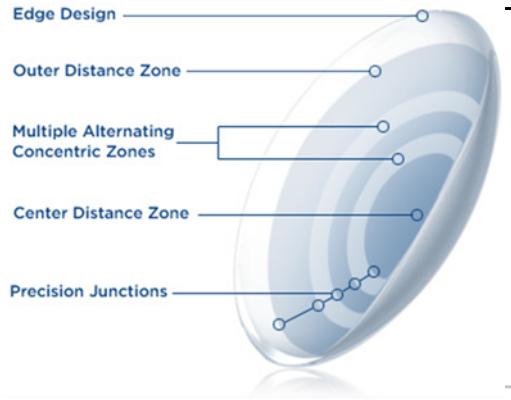
Myope corrected with center distance soft bifocal contact lenses or corneal reshaping lenses



Center Distance Soft Bifocal Contact Lenses

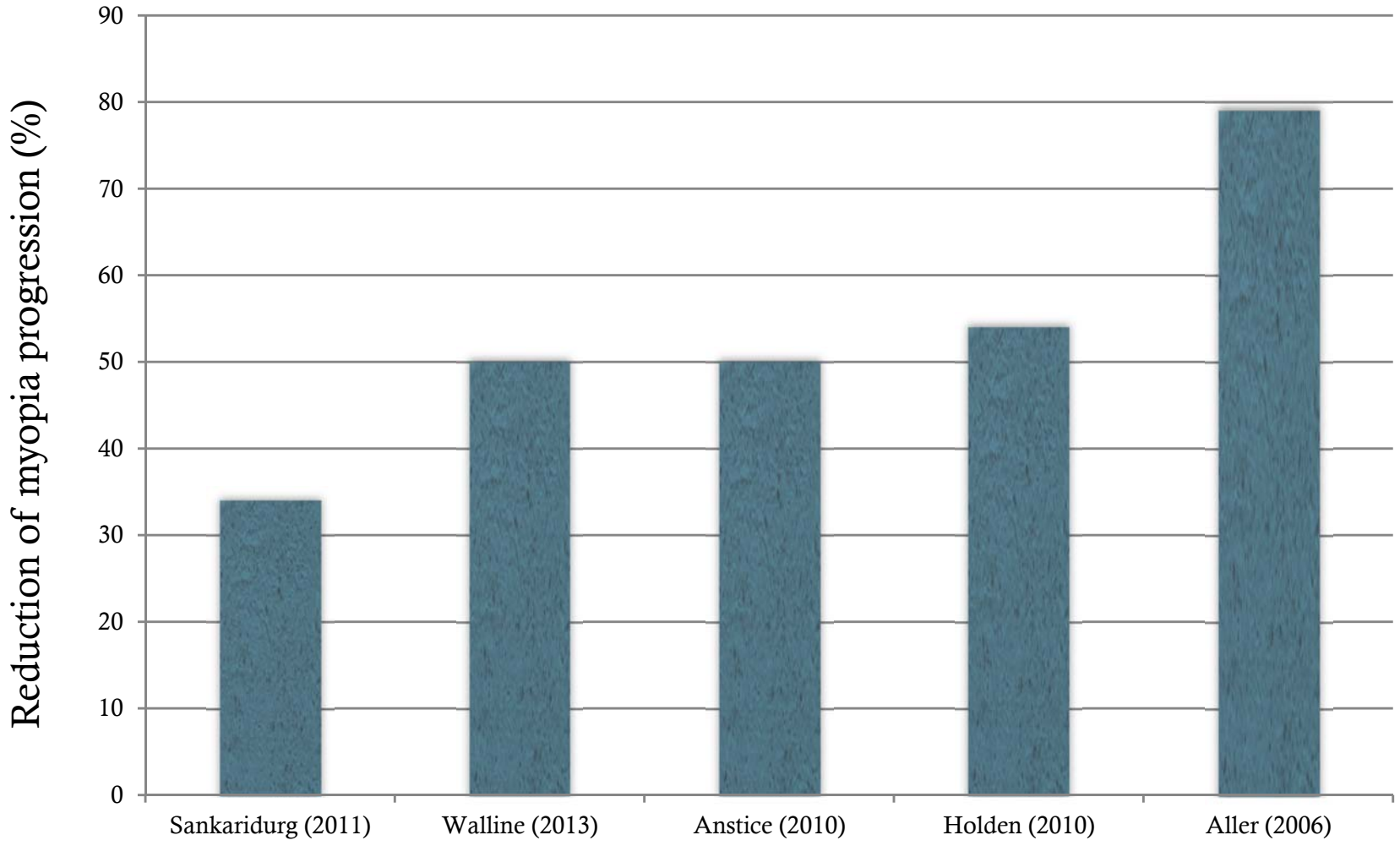
Brand	Proclear Multifocal "D" and XR "D"	Biofinity Multifocal "D"	Acuvue Oasys for Presbyopia	MiSight
Material	Omafilcon A	Comfilcon A	Senofilcon A	Omafilcon A
Power ranges	+20.00 to -20.00 D	+6.00 to -8.00 D	+6.00 to -9.00 D	-0.25 to -6.00 D
Add powers	+1.00 to +4.00 D in 0.50 D steps	+1.00 to +2.50 D in 0.50 D steps	Low, Mid, and High	
Replacement	Monthly	Monthly	Bi-weekly	Daily disposable





Not currently available in the US

Soft Multifocal Contact Lens Studies



Orthokeratology Safety

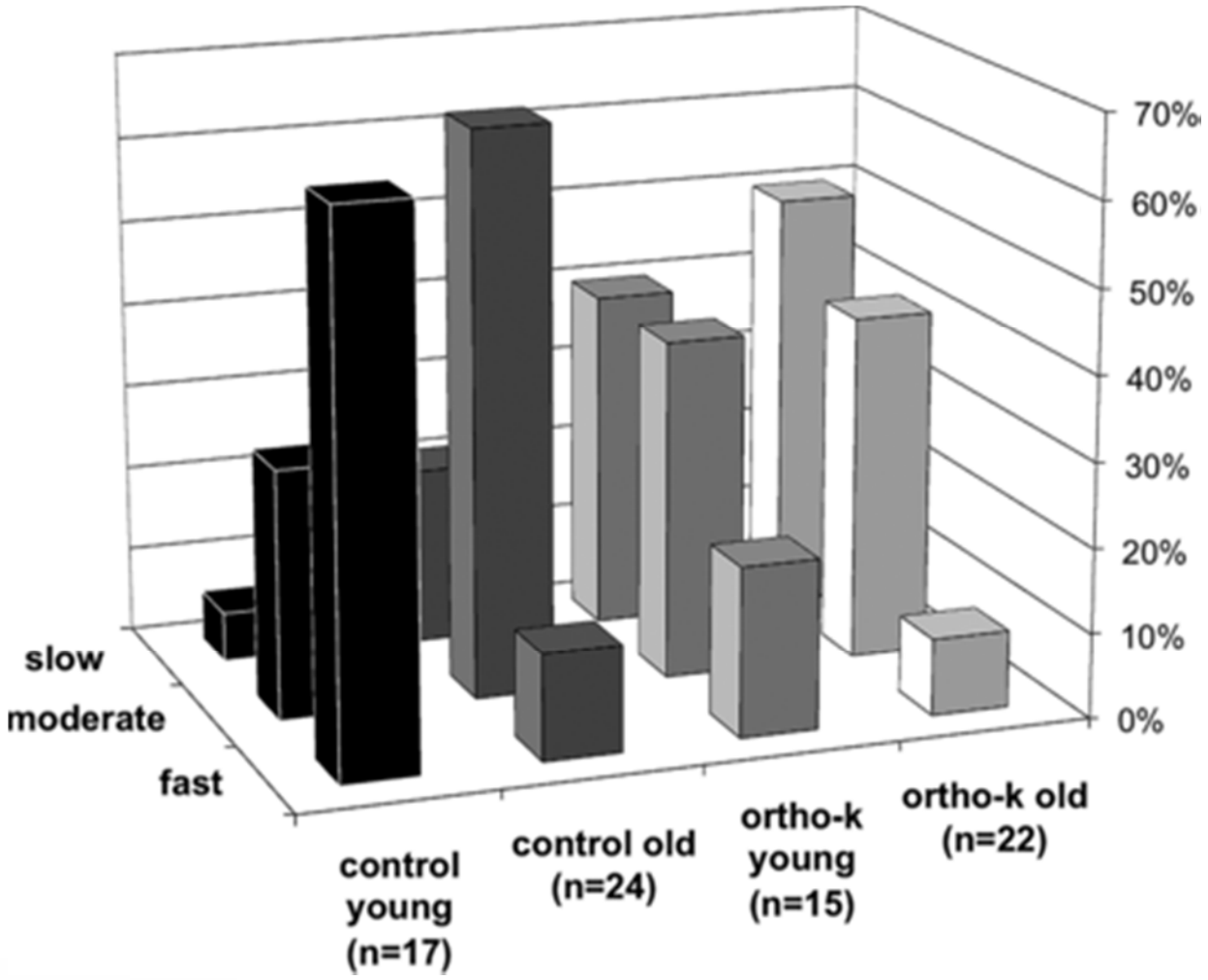
	Children	Adults	Overall
N	677	640	1317
Cases	2	0	2
Years at risk	1435	1164	2599
Rescaled incidence rate (95% CI)	13.9 (1.7 to 50.4)	0 (0 to 31.7)	7.7 (0.9 to 27.8)

*Rescaled rate is per 10,000 patient-years

Conclusion: Overnight corneal reshaping contact lenses and other overnight contact lens modalities show similar risks of microbial keratitis

Bullimore, Sinnott, & Jones-Jordan, 2013

Retardation of Myopia in Orthokeratology (ROMIO) Study



% of subjects who progressed >1.00 D

Group	Ages 7-8	Ages 9-10
Ortho-k	20%	9%
SV spectacles	65%	13%

Cho & Cheung, 2013

Atropine

- Nonselective muscarinic receptor antagonist with high affinity for all five muscarinic receptors
  - All five muscarinic receptors are within the eye
- Concentrations tested:
  - 0.01-1.0%
- Delivery:
  - Solution and ointment
- Dosage
  - 1 GT QHS OU

Atropine Side Effects

- Systemic
  - Nervousness
  - Vomiting
  - Headache
  - Fever
  - Dryness of the mouth
  - Tachycardia
  - Constipation
- Ocular
  - Mydriasis
  - Cycloplegia
  - Photophobia
  - Burning
  - Allergic reaction

Atropine Studies

- Atropine for myopia control was first conducted in in the late 19th century
- ATOM 1 and ATOM 2 (Atropine in the Treatment of Myopia)
  - Use of low concentration atropine
- Fang et al.
  - Prevention of myopia onset
- MIT (Myopia Intervention Trial)
  - Atropine and multifocal spectacles
- Yen et al.
  - Comparison of 1% atropine, 1% cyclopentolate, and saline

Atropine's Mechanism of Action on Myopia Control

- Non-accommodative mechanism
- Retinal
- Scleral
- Choroidal
- Non-muscarinic
- Progression after cessation

Atropine: Side Effects

	Atropine (A) Dose, Mean (SD)			
	A 0.01%	*A 0.1%*	*A 0.5%*	***P* Value**
Accommodation (D)				
-at 1 yr	11.7 (4.3)	6.0 (3.4)	3.6 (3.2)	<0.001*,†,‡
-at 2 yrs	11.8 (3.2)	6.8 (3.4)	4.0 (2.6)	<0.001*,†,‡
-mean change over 1 yr	−4.4 (4.9)	−10.9 (4.0)	−12.4 (3.3)	<0.001*,†,‡
-mean change over 2 yrs	−4.6 (4.2)	−10.1 (4.3)	−11.8 (4.4)	<0.001*,†,‡
Mesopic pupil size (mm)				
-at 1 yr	5.1 (0.9)	6.7 (1.0)	7.5 (1.1)	<0.001*,†,‡
-at 2 yrs	5.1 (0.9)	6.7 (1.1)	7.5 (1.2)	<0.001*,†,‡
-mean change over 1 yr	1.15 (0.78)	2.77 (1.03)	3.50 (1.05)	<0.001*,†,‡
-mean change over 2 yrs	1.15 (0.71)	2.71 (1.12)	3.56 (1.14)	<0.001*,†,‡
Photopic pupil size (mm)				
-at 1 yr	5.6 (0.8)	7.0 (1.0)	7.7 (1.0)	<0.001*,†,‡
-at 2 yrs	5.5 (0.8)	6.9 (1.0)	7.8 (1.1)	<0.001*,†,‡
-mean change over 1 yr	0.91 (0.78)	2.42 (0.91)	3.11 (1.08)	<0.001*,†,‡
-mean change over 2 yrs	0.74 (0.75)	2.25 (1.01)	3.11 (1.10)	<0.001*,†,‡

Chia et al, 2012

Atropine: Side Effects

	Atropine (A) Dose			
	No. of Episode/No. of Children (% Children)			**Exact Test *P* Value***
	A 0.01% (n = 84)	*A 0.1% (n = 155)*	*A 0.5% (n = 161)*	
Adverse events				
Allergic conjunctivitis	0/0 (0)	7/6 (4)	7/7 (4)	0.16
Dermatitis involving eyelids	0/0 (0)	2/1 (1)	4/3 (2)	0.54
Stye/chalazion	2/2 (2)	16/12 (8)	16/12 (7)	0.22
Loss of distant BCVA >1 line	11/11 (13)	20/20 (13)	13/13 (8)	0.38
Others, eye related	2/1 (1)	2/2 (2)	3/3 (2)	1.00
Others, non–eye related	306/69 (82)	470/122 (78)	477/132 (82)	0.73
Severe adverse events				
Events requiring hospitalization	1/1 (1)	3/3 (2)	3/3 (2)	1.00

Chia et al, 2012

Atropine Availability

- Compounding pharmacy required for 0.01% atropine
- Off-label use for myopia control
- Cost

Patient Management and Education

- All treatment options discussed are used off-label for myopia control as there are no FDA approved treatments for myopia control
- Informed consent
- Choose the most appropriate treatment option
  - Consider the impact on the patient's vision, ocular health, and quality of life
- Set realistic expectations for the patient and patient's parent(s)

Thank you!

kbickle12@yahoo.com