Myopia Management

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The Twins

- Originally fit into Orthokeratology July 2003
  - *Age: 13, identical twins*
  - M1 OD:-1.75 DS OS: -1.50DS
  - M2 OU:-1.50 DS
- Discontinued Orthokeratology Aug 2013
  - *Age: 23, still identical twins*
  - M1 OU: -1.75 DS
  - M2 OD: -1.25 -1.00 x 090 OS: -1.50 DS

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The Twins

- Myopic progression
- M1 OD 0.00D OS -0.25D
- M2 OD pl -1.00 x 090 OS 0.00D

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The Twins

- Competitive Swimmers
- College Graduates
- Attended Professional School
- Genetics
  - Mom: OD: -8.00 -0.75 x 090 OS: -8.00 -0.75 x 090
  - Dad: OD: -5.00 DS OS: -5.00 DS
  - Sister: OD: -5.00 -2.50 x 090 OS: -5.00 -2.50 x 090

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Overview

- Myopia
- Literature
- Using the Literature
- Fitting Young People in Contact Lenses
- Case Reports

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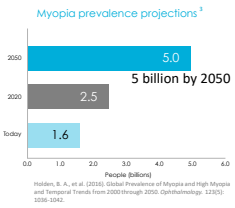
Myopia

- 100 million people in US
  - Increasing in prevalence
  - 25% to 42%

22% current world population
1.5 billion people are myopic

- More prevalent:
  - Industrialized countries
  - Cities vs Rural



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Myopia

- Pathological
  - *Presents before age of 6, abnormal and extreme axial elongation*
- School Age
  - *6 and 18 years of age, progress and stabilize by late teens / early twenties*
- Adult onset
  - *20 and 40 years of age, associated with accommodative anomalies and near vision dominated occupations*

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Myopia

Progression in all three groups is due to **elongation of the axial length**, which is primarily due to the elongation of the vitreous chamber depth of the eye

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Myopia

- Myopia
  - Sight-threatening complications associated with high myopia
    - Macular degeneration
      - Macular choroidal neovascularization: 9x greater risk with myopia 5 to 6D
    - Retinal detachments
      - 0.015% incidence with <4.74D vs 3.2% > 6.00D
    - Cataracts
    - Glaucoma

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Myopia

- Control Progression
  - Decrease the rate of eye growth
  - During Development
    - Pharmacological, environmental, and optical interventions
- Reduce/Delay of Onset
  - Low concentration Atropine
  - Time outdoors

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Myopia

- What leads to the Development?
  - Genetics
  - Environmental Factors
  - Combination of the two

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Myopia

- Genetic
  - Higher prevalence with 2 myopic parents
    - Refractive error of the parents is the most important predictor
  - Multiple interacting genes influence refractive error
  - Parents and offspring share both environmental and genetic factors.

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Genetics

My Family	OD	OS
Mom	-4.00 – 0.50 x 180	-3.50 – 0.25 x 170
Dad	-1.50 -1.50 x 005	-1.50 -2.25 x 174
Sister	-4.75 – 050 x 015	-4.75 -1.25 x 0165
Me	-3.75 -0.25 x 170	-3.50 -0.50 x 170
Husband (did not wear until 15yo)	-2.50DS	-2.50DS

?

2018 G	OD: -0.75	OS: -1.00
2019 B	OD: pl	OS: pl -0.25 x 086

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Myopia

- Environmental factors
  - Positive Correlation
    - Intelligence
    - Academic Advancement
    - Avocations requiring near vision use
    - Professional School
    - Confined to small spaces (submarines)
    - Greater time doing near work = increased incident of myopia

Activities that increase the exposure to optical blur.

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Myopia

- Accommodation
  - Greater lag of accommodations
  - High ACA rations
  - More esophoric
  - Decreased accommodative amplitude
  - Worse Accommodative responses
  - Difference not great enough between myopes and emmetropes to explain myopia development
  - Which came first????

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Myopia

- "Optical Blur produced by the lag of accommodation may be the signal that drives excessive eye growth."
  - Animal studies the have found that degradation of visual input using either diffusers or negative lenses causes excessive eye growth and myopia
    - Occurred with plus and minus lenses
    - Occurred in half the eye
    - Occurred when the optic nerve was severed.

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Myopia

- Blurred image results in alternation of growth signals within the eye
- Demonstrates that the signaling cascade regulating refractive development is within the eye itself and does not required feedback from the brain.
- Retina sends remodeling signals to the sclera to alter its shape to place an image on the retina – emmetropization.

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Myopia

- Sunlight/Outdoor Time
  - Amount of time spent outdoors is more closely related to the development of myopia than amount of time spent reading, studying, CPU
  - Number of studies shown a negative correlation between amount of time children spent outdoors and their refractive error.
  - Myopia becomes more common in children who spend less time outdoors
  - MOA – pinhole effect = reduces peripheral blur; UV exposure affecting scleral cross-linking

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Myopia

- Collaborative Longitudinal Evaluation of Ethnicity and Refractive effort (CLEERE) study
  - If a child is less hyperopic than +0.75D by first grade, the child is at an increased risk to develop myopia.
  - 6 yoM OD: +.25 OS +0.50
  - 6yoF OD: +0.25 OS pl

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Prevention of Myopia Onset

- Outdoor Time
  - *Outdoor time seems to delay the onset of myopia but does no reduce the progression of myopic refractive error.*
  - *10 hours/week*
- Low dose Atropine

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Myopia

- 12 month study; ages 6 to 12
  - *+1.00 to -1.00 RE (premyopic)*
    - *Compared no treatment to 0.025% atropine qdhs*
  - *21% atropine treated became myopic*
  - *54% not receiving atropine became myopic*
  - *Refractive error progression also less for atropine treated children*
  - *No visual complaints from either group of children*

Fang PC, et al. Prevention of myopia onset with 0.025% atropine in premyopic children. J Ocul Pharmacol Ther 2010; 26:341-45.

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Myopia

How do we control progression?

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Myopia

- Hyperopic Peripheral defocus signal for ocular elongation

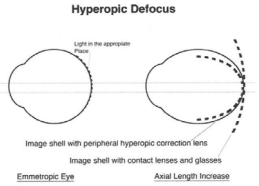

Fig 3. Current status on the dev & tx of myopia; Cooper, et al

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Myopia

- Mean progression rate:
  - 0.55D/year Caucasian
  - 0.63D/year Hong Kong Chinese
  - 0.82D/year Asian
  - 0.80D/ year females (combined ethnicities)
  - 0.71D/ year males (combined ethnicities)

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Myopia

16 years = average age for stabilization of childhood myopia

– *Progression past age 20: young adult progression*

- *Recent environmental changes have resulted in sharp increase in myopia and increase in the age of progression, overall magnitude.*

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Myopia
How to educate?

- *8/5/14 15yo AA female*

	OD	OS
08/21/12	-7.25 -1.75 x 160	-6.00 -2.00 x 005
8/5/14	-8.75 -1.50 x 165	-8.00 -1.75 x 025
Progression	-0.75D/ year	-1.00/year

- *8/14/14 11 yo AA female*

	OD	OS
7/5/12	*-5.50 -1.50 x 006*	-6.00 -2.00 x 178
7/18/13	-6.75 -1.50 x 006	-6.50 -2.25 x 178
8/14/14	-8.25 -1.75 x 006	-8.25 -2.50 x 178
Progression	0.91D/year	0.75D/ year

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Clinically meaningful control

- *Eyecare practitioners believe that myopia progression must be slowed by at least 50% to be clinically meaningful for patients*
- *Ave rate of myopia progression 0.5D/year*
- *8yo diagnosed with -1.00D*
  – *Progresses to 16 at average rate -5.00D myope*

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Clinically meaningful control

% Myopia Progression Reduced	Final myopia (at 16 years)
0	-5.00D
25	-4.00D
50	-3.00D
75	-2.00D
100	-1.00D

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Clinical Implications

- Gifford and Gifford suggest:
  – If a myopic child could be kept from progressing from a -1.00D to -3.00D
  – Decrease the risk:
    - Myopic Maculopathy by 4 to 5 times
    - Retinal Detachment by 3 times
    - Posterior Subcapsular Cataract by 1.5 times

Gifford P, Gifford KL. The future of myopia control contact lenses. *Optom Vis Sci* 2016;93:336-343.

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Myopia

- *How do we treat myopic progression*
  – *Reducing the lag of accommodation*
  – *Reducing both Central and Peripheral defocus*
  – *Blocking myopiagenic signaling in the eye*

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The studied options for control of myopic progression

- Undercorrection
- Soft spherical
- GP's
- Bifocal/PAL
- Spectacles
- Orthokeratology
- Soft CL Bifocal
- Pirenzepine
- Atropine

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Undercorrection

- DON'T DO IT!
- 2 studies:
  - an increase in the progression of myopia
  - no change as compared to fully corrected controls
- Associated with faster progression of myopia

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GP Contact Lenses

- Contact Lens and Myopia Progression (CLAMP) Study
  - Refractive changes most likely do to corneal flattening (temporary) from GP lens wear; did not represent a true slowing of myopia
- GP wear vs Spectacle wear
  - No significant difference in refractive error
- GP's do not reduce the progression of myopia

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Bifocal/Multifocal Spectacles

- Rationale:
  - *if accommodation caused an increase in myopia, the bifocals/multifocals would reduce the accommodative response and slow myopia progression*
  - *Myopic children do not accommodate as well as emmetropic children.*

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Bifocal/Multifocal Spectacles

Researcher	Methods/Finding	Esophoric
Goss	+0.75D to +1.25D BF add SV specs No statistically sig diff	0.32D/year vs 0.54D year
Grosvenor	+1.00, +2.00 BF SV specs No statistically sig diff	Goss re-analyzed 0.20D/ year less progression vs SV
Fulk	+1.50 BF All esophoric children	20% reduction in progression for eso BF vs SV
COMET	+2.00D PAL SV specs Sig at 3 year, not at 5 years	

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Bifocal/Multifocal Spectacles

- Benefits: low risk of complications or adverse side effects, effectiveness in esophoric children (30% of myopic children)
- Disadvantages: Lack of strong scientific support of efficacy in the majority of non-esophoric myopes; poor long-term data

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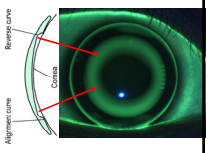
Orthokeratology (OK)

- Reverse Geometry Gas Permeable Lens
- Flatten central cornea to correct for Myopia
- Mid-peripheral steepening
  - Creates less peripheral defocus versus single plane correction
  - Theoretically corrects hyperopic peripheral defocus



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Epithelial Changes

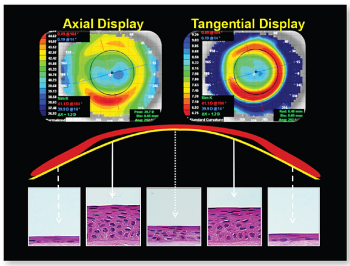

Image: https://www.clspectrum.com/issues/2017/march-2017/the-anatomy-of-a-modern-orthokeratology-lens; Korszen and Caroline; CL Spectrum; 3/2017

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Orthokeratology (OK)

- Kang/Swarbrick
  - Myopic children have relative peripheral hyperopia as compared to their central refraction
  - OK lenses for 3 months vs GP in other eye
  - 30 degrees temporal field / 20 degree nasal field
  - Temporal peripheral refraction was similar to center and nasal was significantly myopic in OK eye
  - No change in either central or peripheral refraction in control eye
  - OK changes the relative peripheral hyperopia found at baseline to peripheral myopia after OK.

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Orthokeratology (OK)

- Reim –retrospective chart review
  - Ages 6 to 18; myopia 0.50D to 5.25D; Dreimlens
  - 253 eyes after 1 year of lens wear
  - 164 eyes after3 years of lens wear
  - Mean increase in myopia 0.39D over 3 years or 0.13D/year
  - *Significantly less than average reported progression*

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Orthokeratology (OK)

- Walline – COOKI
  - Refractive Error, Visual changes, SLE
  - Before and after 6 months of OK wear
  - 29 subjects; 8 to 11yo; -0.75D to -5.00D (<1.50Dcyl)
  - CRT (paragon)
  - No lasting adverse visual effects from OK lenses
  - *"overnight corneal reshaping Contact lenses was efficacious for young myopic patients"*

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Orthokeratology (OK)

- Cho – LORIC – compared axial length (2 year)
  - *7 to 12 yo; -0.25D to -4.50D (< 2.00D cyl)*
  - Fit in OK or SV specs (81% completed the study)
  - *Less increase in AL and VCD measurements in OK group vs SV spectacles*
  - *Significant slowing of eye growth in OK group*
  - *AL increased OK: 0.29 +/- 0.27mm Spec: 0.54+/-0.27mm*
  - *VCD increase OK: 0.23+/-0.25mm spec: 0.48+/-0.26mm*
  - *46% average myopic reduction with OK*

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Orthokeratology (OK)

- Walline – CRAYON
  - compared axial length (2 year)
  - *40: 8 to 11yo; -0.75D and -4.00D (<1.00D cyl)*
  - *CRT (paragon); 70% completed the study*
  - *OK lens wearer vs soft CL lens wearers showed average of 0.16mm/year less AL and 0.1mm in VCD growth.*
  - *38% average reduction in myopic progression.*
  - *30% drop-out rate; none do to complications; most due to lack of interest in wearing contact lenses.*

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Orthokeratology (OK)

- Kakita – study axial elongation (2 year)
  - Spectacles wearers control group
  - OK AL increased: 0.39+/- 0.27mm vs specs: 0.61+/-0.24mm
  - *OK slows AL by approximately 36%, as compared to spectacle lens correction*
- Santodomingo-Rubido – study axial elongation
  - 2 year study OK vs SV specs
  - 0.47mm increase OK vs 0.69mm increase specs

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Orthokeratology (OK)

- Mok and Chung –
  - RE and central corneal curvature (7year)
  - OK vs spectacles,
  - OK 0.05D/year ; 0.37+/-.49D
  - spectacles 0.29D/year ; 2.06 +/- 0.81D
  - *Reduced rate of progression of both OK and spectacle wearers compared to other studies; provides good pilot data demo the long-term effects of OK.*

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Orthokeratology (OK)

- Hiraoka – 5 year Axial elongation
  - OK vs specs; 59 subjects
  - OK AL 0.99 +/- 0.47mm; specs 1.41 +/- 0.68mm
  - *Difference in AL OK vs spectacles significant years 1-3, but not 4 and 5.*
  - *Similar to COMET bifocal study tx effect diminish after 3 years*

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Orthokeratology (OK)

- Cho – ROMIO
  - 102; 6 to 10 yo; -0.50D to -4.00D (<1.25D cyl)
  - Either OK or SV spec 2 years
  - Axial length measured at baseline and every 6mo
  - Axial elongation sig slower in OK group
  - Age correlation: younger subject had more axial elongation than older subjects
    - 20% subject ages 7-8 and 9% subjects ages 9-10 in OK group progressed >1.00D/year

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Orthokeratology (OK)

- Summary
  - OK results in ~ 40% reduction in the progression of myopia
  - Advantages: eliminates need for daytime CL wear and reduces the progression of myopia
  - Disadvantages: cost, risk of infection, discomfort, problems with insertion and removal, no good controlled long term studies.

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Orthokeratology (OK)

- Summary
  - Ideal Candidates:
  - Children with moderate myopia
    - Between 1.25 to 4.0 diopters
  - Children with large pupils

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Orthokeratology (OK)

- Summary
- Lower myopia – less mid-peripheral plus induced
- Higher myopia – harder to achieve targeted prescription

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Soft Bifocal Contact Lenses

- *If hyperopic defocus stimulated eye growth*
- *soft bifocal CL that result in a myopic shift in defocus: potentially slow myopia progression*
- *while still providing clear central vision*
  - *Dual-Focus Lens*
  - *Center Distance multifocal lens*
  - *Extended Depth of Focus*

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Soft Bifocal Contact Lenses

- Anstice and Phillips – Dual-Focus
  - Center Distance, concentric tx zones 2.00D peripheral myopic retinal defocus; control SV dist CL (other eye)
  - 10 months each eye

	Treatment Group	Control Group
Refractive change	-0.44D+/- 0.33D	-0.69+/-0.38D
Axial Length increase	0.11+/-0.09mm	0.22+/-0.10mm

  - *70% of children, myopia progression reduced by 30% or more wearing dual focus lens*

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Soft Bifocal Contact Lenses

- Walline – Proclear "D" lens / +2.00add (2year)
  - 8 to 11yo, -1.00D to -6.00D, <1.00D astigmatism

	Treatment Group	Control Group
Refractive change	-0.51+/-0.06D	-1.03 +/- 0.06D
Axial Length increase	0.29+/-0.03mm	0.41 +/-0.03mm

  - *50% reduction in myopia progression in MF group*
  - *29% reduction in axial elongation in MF group*

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Soft Bifocal Contact Lenses

- Sankaridurg- soft multifocal (lotrafilcon B)
  - Followed for 12 months
    - 45 treatment/40 control SV spectacles
  - *34% less refractive progression in soft MF*
  - *33% less increase in axial length in soft MF*

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Soft Bifocal Contact Lens

- Holden, Sankaridurg – 43 months
  - Ages 8 to 14 years, 40 initially enrolled
  - Test Lens
    - Relatively narrow central optical zone (2.3mm)
    - Distance center
    - Peripheral plus (+1.50D)
  - Control Lens – spherical soft
- Test Lens: myopia progression slowed by 39%
  - Axial elongation slowed by 41%

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Soft Multifocal Contact Lenses

- Cooper, et al; retrospective case series
- NaturalVue – extended depth of Focus
  - 32 patients, ages 6-19; progressed -0.50/year
  - OD: -0.85D/year +/- 0.43D *to* -0.04D +/- 0.18D
  - OS: -0.90D/year +/- 0.57D *to* -0.03D+/- 0.17D
  - OD reduction 95.4%
  - OS reduction 96.25%

Cooper et al. Case Series Analysis of Myopic Progression Control with a Unique Extended depth of focus Multifocal Contact Lens. *Eye and Cont Lens* 2017;0:1-9.

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Soft Multifocal Contact Lenses

NaturalVue (etafilcon A) Multifocal Daily Disposable Soft (Hydrophilic) Contact Lenses are indicated for daily wear **for the correction of refractive ametropia (myopia and hyperopia) and/or presbyopia** in aphakic and/or non-aphakic persons with non-diseased eyes in powers from -20.00 to +20.00 diopters and with non-diseased eyes who may require a reading addition of up to +3.00D. The lenses may be worn by persons who exhibit astigmatism of 2.00 diopters or less that does not interfere with visual acuity.

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Soft Multifocal Contact Lenses

- MiSight (CooperVision)
  - 8 to 12 yo; -0.75D to -4.00D (<1.00D cyl)
  - Lens study group; control grp: SV SCL
  - 2 year Follow-up:

	Treatment Group
Refractive change	0.54D less than control
Axial Length increase	0.24mm less growth than control

  - 59% reduction in progression & 53% reduction in axial length

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Soft Bifocal Contact Lenses

- Summary
  - Center distance design soft MF may slow average growth of the myopic
  - Treatment effect of axial length elongation continues to accrue beyond the 1st year of treatment
  - Myopia control similar in magnitude to corneal reshaping CL

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Muscarinic antagonist

- Atropine
  - Non-selective muscarinic antagonist
- Pirenzepine
  - M1 selective muscarinic antagonist
    - Does not affect pupil size or accommodation

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Pirenzepine

- Not Currently commercially available in the US
- 1 year period - 2% ophthalmic gel
  - Effective (50% reduction)
- 2 year period – 2% ophthalmic gel
  - Effective in slowing progression of myopia
  - No significant change in axial length in treatment group

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Atropine MOA

- Non-accommodative mechanism of action
  - Chicken muscles only contain nicotinic receptors
  - Translucent occluder monocularly to increase axial elongation
  - 20.9D experimentally induced myopia in chicks without atropine vs 2.8D in treated chicks
  - Significant reduction in axial length and myopia progression

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Atropine MOA

- Inhibits axial length elongation in animals that have no accommodative mechanism
  - Optic nerve cut
  - With regionally induced AL change from blur
- Exact mechanism unknown – multiple studies indicate that atropine has an effect altering the sclera.

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Atropine Side Effects:

- Pupillary Dilation and cycloplegia
  - Glare, photophobia, and near vision blur
- Hot and Dry Skin
- Facial flushing
- Dryness of the nose
- Loss of taste
- Constipation
- Difficulty swallowing
- Difficulty sleeping
- Drowsiness
- Excitement
- Changes in heartbeat
- Hallucinations
- Fever
- Headache
- Dizziness
- Nervousness
- Nausea
- Vomiting
- Allergic reactions

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Atropine

- ATOM 1 – 1% atropine in 400 children
  - Vs placebo
  - Control eye progressed 0.6D/year
  - Atropine treated eye was 0.14D/year
  - 77% reduction in the progression

Chua et al. Atropine for the treatment of childhood myopia. Ophthalmology 2006;113:2285-2291.

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Atropine

- Number of studies evaluating dosage.
- ATOM 2
  - 0.5%, 0.1%, and 0.01%
- Axial length comparison
  - No statistical difference in AL between the placebo and atropine 0.01% group.

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Atropine

- Important for two reasons:
  - Primary purpose of slowing myopia progression is to reduce the axial elongation which in turn decrease future retinal complications.
  - Minimal difference between placebo and 0.01% AL changes, with significant refractive changes should make the clinician question the true effect of atropine 0.01%

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Atropine

Treatment Method	Percentage Reduction	Projected increase in myopia after 1 year
Atropine 0.25%	58%	0.25
Atropine 0.01%	60%	0.24
Atropine 0.1%	62%	0.23
Atropine 0.05%	65%	0.21
Seasonal Atropine	67%	0.20
Atropine 0.025%	76%	0.14
Atropine 0.5%	80%	0.12
Atropine 1%	90%	0.06

Atropine 1% is the only commercially available option

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Atropine

- Short-term use may not lead to a permanent treatment effect
- Higher concentration(s) of atropine demonstrate greater myopia control
- 1 and 2 year after discontinuation of tx
  - 0.01% strongest total myopia control
  - 1.0% weakest total myopia control
    - Due to faster myopia progression after discontinuation for higher concentrations of atropine

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Atropine

- Rebound Effect explanation
- Atropine greater cycloplegic effect than 1% cyclopentolate
  - Cyclopentolate used for follow-up refractions
  - Creates the impression that atropine slows the progression of myopia more than it really does

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Atropine

- Rebound Effect explanation
- Atropine suppresses the signal for axial elongation
  - By abruptly stopping the higher doses – results in faster elongation than discontinuation of lower concentrations.
- Findings suggest – atropine use should be tapered down rather an abruptly discontinued

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Atropine

- 1%
  - Greater side effects; should be used for at least 5 years and tapered when discontinued
- 0.01%
  - Fewer side effects; should be used for at least 5 years and then stopped.
    - Might be less effective than suggested, especially when considering AL measurements

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Atropine

- Micropine
  - Eyenovia
  - Micro-therapuetic formulation of Atropine
  - Phase III FDA trial
  - Designed to slow the progression of Myopia

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Using the literature

- Bifocal spectacles, GP's, undercorrection don't work
- Pirenzepine is not available
- Atropine works well, low dose the best
- Soft multifocals and OK both control myopia and are viable options for children

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Fitting Kids in Contact Lenses

- ACHIEVE
  - the adolescent and child health initiative to encourage vision empowerment study
  - Contact Lenses significantly improve how children feel about:
    - *their physical appearance*
    - *their ability to play sports*
    - *their acceptance among friends*

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Fitting Kids in Contact Lenses

- Studies indicate children as young as 8 are capable CL (soft, GP, and OK)
- CLIP study
  - total chair time only 15 minutes longer
  - 8 to 12 yo vs 13 to 18 yo
- Mature enough to independently care for their lenses

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Fitting Kids in Contact Lenses

- Important factors for successful fitting:
  - *Interest and Motivation*
  - *Maturity ability to independently take care of CL*
  - *Personal hygiene habits*
  - *Sports*
  - *Prescription requirements*
  - *Self-esteem*
  - *Pre-existing medical conditions*

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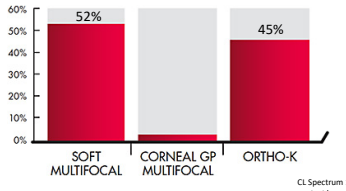
Myopia Control

- 28% of CL Spectrum readers respondents, actively practice myopia control



CL Spectrum 1/19; CL 2018: Figure 6. 2018 contact lens design usage in myopia control

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Myopia Control Clinical Protocol

- Baseline data
  - Manifest refraction
  - Keratometry readings/topography
  - Anterior Segment Evaluation
  - A scan

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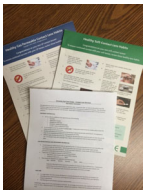
Myopia Control Clinical Protocol



- Education
  - Lens options
  - Pharmacological Options
  - Environmental Changes
- Appropriate Age to fit
  - Consider current Rx and rate of change
- Goal: Clinically meaningful control
- Monitor with Axial length measurements

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https://calculator.brienholdenvision.org/

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Myopia Control Clinical Protocol

- 1st grade, refraction more myopic than +0.75D
  - Educate parents about Atropine and Spending Time outdoors; Rx Atropine 0.01% if parents are willing
- Age 8-11
  - Monitor for progression (concern with > 0.50D/year)
  - Use calculator to predict final Rx
  - Rx either SMF or Orthokeratology Lenses to slow myopia progression

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Myopia Control Clinical Protocol

- If SMF/OK progression <0.50D/year
  - Monitor with 6 month refraction checks
- If SMF or Orthokeratology without Atropine
  - > 0.50D/year progression
  - Consider adding 0.01% Atropine

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Myopia Control Clinical Protocol

- If you use Ortho-K or SMF
  - Check refraction every 6 month
  - If progress by <0.5D/year
    - Continue with current treatment
  - If progress by > 0.5D/year
    - Consider adding low does Atropine Therapy

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Fitting Kids in Contact Lenses

- Let patient touch/feel lens prior to insertion
- Handling
- Care Instructions
- Wearing Schedule

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Soft Multifocal CL

- Distance center design
  - full distance prescription
  - start with +2.50D add

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Soft Multifocal Contact Lenses

Company	Brand	Distance Powers	Adds
Coopervision	Biofinity Multifocal "D"	+6.00 to -8.00 (0.50 step above -6)	+1.00, +1.50, +2.00, +2.50
Coopervision	Proclear Multifocal "D" **also available in MF toric design**	+6.00 to -8.00 (0.50 step above -6)	+1.00, +1.50, +2.00, +2.50
Johnson and Johnson	Acuvue Oasys for Presbyopia	+6.00 to -9.00	Low (+0.75 to +1.25) Med(+1.50 to +1.75) High(+2.00 to +2.50)
Visioneering Technologies, Inc	NaturalVue (daily disposable)	-0.25 to -12.25D in 0.25D steps	1 Universal ADD power, effective up to +3.00D

The above designs are center Distance soft bifocal contact lenses with moderate to high add powers, commercially available in the US.

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Soft Multifocal CL

- Clinical Appointment Schedule:
  - 1 week, 1 month, 6 months
- Follow-up Clinical Protocol
  - A scan
  - Lens fit evaluation/SLE
  - Vas, OR and Manifest refraction

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Soft Multifocal CL

- What if child can not see well with +2.50add?
  - Initiate a build-up period
    - Begin with +1.50 or +2.00 add
      - Wear for 1 month
    - Change to next step up
      - Wear for 1 month
  - Incorporate distance over-refraction

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Soft Multifocal CL

- Schulle KL, et al
  - BLINK study group (April 2018)
    - To determine the spherical over-refraction necessary to obtain BCVA when fitting myopic children with center distance MFCL.
    - Children typically require -0.50D to -0.75D SOR to achieve BCVA
    - With +2.50add in MFCL

Schulle KL et al. Visual acuity and over-refraction in myopic children fitted with soft multifocal contact lenses. Optom Vis Science. 2018;95(4):292-298.

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Soft Multifocal CL

- Clinical Considerations
  - Check refraction every 6 months
  - If child has progressed < 0.5D/year
    - Continue with SMF
  - If child has progressed >0.5D/year
    - Consider adding Atropine Therapy to SMF therapy

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Soft Multifocal CL

- 11 year old female (June 2018)
  - OD: -1.00 OS: -0.75
  - Fit into Biofinity MF "D" lenses
  - OD: -1.00/+2.00D 20/25- OS: -0.75/+2.00D 20/25-
  - OR: -0.25 OD, OS
  - -1.25 / +2.00D -1.00/+2.00D x 1 month
  - -1.25 / +2.50D -1.00 / +2.50D Finalized

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Patient RW (7/20/12)

- 8 year old female complains of Myopia progression over the last 7 months
- Parents are hoping to use CL to slow myopic progression

Date	OD Rx	OS RX
12-7-11	-1.00	-1.00
7-3-12	-1.75 -0.25 x150	-1.75-0.25 x 162

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Patient RW

- -3.00 / +2.50 D lens OU
- -3.25/+2.50D lens OU 11/16/2015

Date	OD	OS
8/13/14	-3.00 -0.25 x 165	-3.00-0.25x165
3/18/15	-3.00DS	-3.25DS
11/16/15	-3.25DS	-3.25DS
1/20/17	-3.25DS	-3.25DS
2/16/18	-3.50DS	-3.50DS

- Progression: OD:-1.75/6yrs; OS -1.75/6yrs

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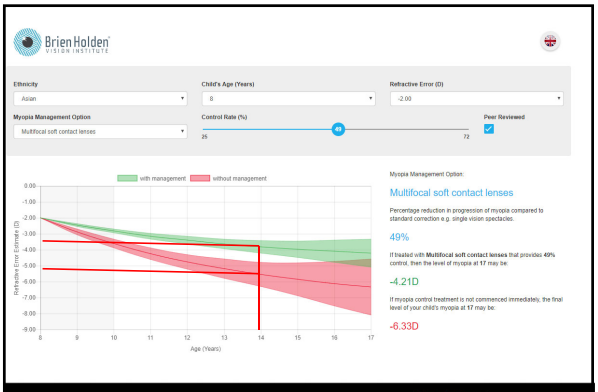

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Patient HE

- 11 yo AA female

	OD	OS
7/5/12	*-5.50 -1.50 x 006*	-6.00 -2.00 x 178
7/18/13	-6.75 -1.50 x 006	-6.50 -2.25 x 178
8/14/14	-8.25 -1.75 x 006	-8.25 -2.50 x 178
Progression	0.91D/year	0.75D/ year

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Patient HE

- 11 yo AA female ATROPINE!!!!!!

	OD	OS
7/5/12	*-5.50 -1.50 x 006*	-6.00 -2.00 x 178
7/18/13	-6.75 -1.50 x 006	-6.50 -2.25 x 178
8/14/14	-8.25 -1.75 x 006	-8.25 -2.50 x 178
Progression	0.91D/year	0.75D/ year

- Proclear Multifocal Toric
  - OD: -7.50 – 1.25 x 180 D lens +2.00 add
  - OS -7.50 -1.75 x 180 D lens +2.00 add

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Patient TK

- 11 yo female
- Softball pitcher

	OD	OS
10/29/10	-1.00	-0.75 -0.50 x 118
12/23/11	-1.00	-0.75-0.75 x 118
10/8/13	-1.25	-1.50-0.75 x 118
10/4/14	-2.25	-2.00

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Patient TK

- Parents Rx
  - Mom: -4.00 -1.00 x 015 -4.75 -1.00 x 165
  - Dad: -2.25 -1.50 x 085 -3.50 -1.00 x 103

- Fit into Biofinity Multifocal D lens OU
  - OD -2.25 +2.00D 20/20
  - OS -2.00 +2.00 D 20/20

Daily Disposable spherical Lenses for when pitching

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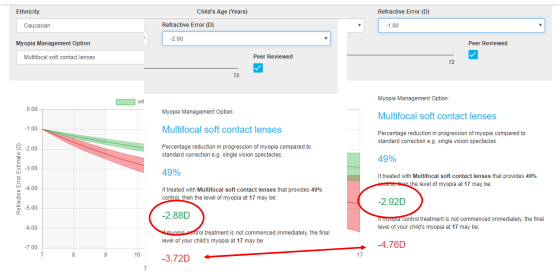
Patient TK



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Patient TK

- 15 year old
- -3.00D OU
- Wearing Biofinity
- -3.00D/+2.00 D

- Average progression (2014-2018):
  - ~ 0.25D/ year

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Patient KP

- 7 yo female (10-9-14)
- MR
  - OD: -4.00-0.50 x 005
  - OS: -4.50 -0.50 x 165

- What do you recommend?

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Patient KP

Biofinity MF D
-4.00 +2.00D
-4.50 +2.00D

Date	OD	OS
4/10/2015	-4.25-0.50 x 180	-4.50 -0.75 x 180
6/26/2015	-4.25-0.25 x 110	-4.50 -0.25 x 135
1/27/16	-4.75 -0.25 x 110	-5.25 -0.25 x 135
6/21/17	-5.50 -0.50 x 020	-5.75 -0.25 x 163

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Patient KP

Myopic Progression:
1 year: OD -0.25 OS pl
1.5 years: OD -0.75 OS -0.75
3 years: OD: -1.50 OS -1.25

**Current research would recommend Atropine treatment in conjunction with SMF.

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Patient SP

- 11/10/2015
  - 11 yo F, 6th grade
  - Presents for OrthoK, neighbor was fit with good success and she was referred to Dr. DeKinder to also be fit.
  - Worn glasses since 2nd grade, no CL Hx
  - MR OD -4.25 -0.50 x 150 OS -3.75 x-1.00 x 178
- Good candidate for OrthoK?

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Patient SP

- 11/10/2015
  - Paragon CRT
  - 1 week F/U 20/200 OD, 20/200 OS
    - Missed a few nights of wear
  - 2 week F/U 20/70- OD, 20/100 OS
    - Compliant with lens wear
  - 1 month F/U 20/70- OD, 20/200 OS
    - Patient notes no improvement with vision
    - Topo: minimal flattening OU

WHAT NOW????

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Patient SP

- 2/25/16
  - After no improvement with VA and a broken CRT lens – we decided to switch to Soft MF lenses
  - Biofinity MFD
    - -4.00 / +2.00 D
    - -4.00 / +2.00 D

1-9-2018
OD: -4.75 Progression: - 0.50 (2 yrs)
OS -4.00 Progression: -0.25 (2yrs)

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Patient OW

- 5/2014 -12yoF
  - OD -6.25 OS -8.00
  - How do you educate?
  - What do you prescribe?

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Patient OW

- 5/2014 -12yoF
  - OD -6.25 OS -8.00
  - BFMF D OD: -5.50 OS -7.00 +2.00D
- In 2018 she is 16 years old….now what?

Myopic Progression
OD: -0.75/4 years
OS: -0.25/4 years

- 2/2018
  - OD: -7.00 OS -8.25
    - Switched to Biofinity Spherical lenses

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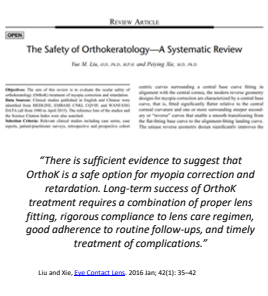
OrthoK - Safety Concerns?


REVIEW ARTICLE

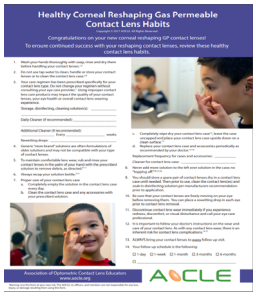
OPEN

The Safety of Orthokeratology—A Systematic Review

Yue M. Liu, o.d., m.s., m.p.h. and Peiying Xie, m.d., ph.d.

"There is sufficient evidence to suggest that OrthoK is a safe option for myopia correction and retardation. Long-term success of OrthoK treatment requires a combination of proper lens fitting, rigorous compliance to lens care regimen, good adherence to routine follow-ups, and timely treatment of complications."

Liu and Xie, Eye Contact Lens. 2016 Jan; 42(1): 35–42



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Orthokeratology

- Baseline Evaluation
  - Manifest refraction
    - Myopia between -1.00 and -5.00D
    - Astigmatism <1.50D WTRand <0.75D ATR
    - Avoid limbal to limbal astigmatism
  - Keratometry and Topography
    - Check eccentricity
  - Healthy anterior segment

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Orthokeratology

- Topography
  - Take multiple maps
  - Eccentricity
    - 0.2 eccentricity for each predicted diopter of correction
    - 0.6eccentricity predicts 3.00D possible correction
  - Flat keratometry reading > 40.00D
  - Elevation Difference

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Patient KL

- SMART study participant
- 07/05/07 12 yo female
  - MR: OD -1.00 DS OS -1.00DS
  - Fit into Emerald VST Orthokeratology lens

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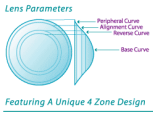
Emerald VST (Bausch and Lomb)



Approved treatment range	
Refractive Error	-1.00D to -5.00
Cylinder	< -1.50D
Keratometry	40.00D to 46.00D

Standard Lens Parameters	
Diameter*	10.2mm, 10.6mm, 11.0mm
Power	+0.75D
Center Thickness	0.22mm

*selection based on HVID

***Need Refraction Keratometry & HVID to order Lenses, lab designed*

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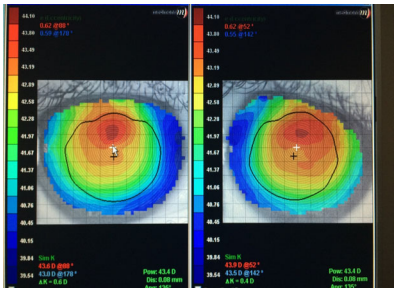
Patient KL



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Patient KL

- 1 year regression visit
  - MR: OD -1.00 -0.25 x 080 OS: -0.75 -0.50 x 130
- 2 year regression visit
  - MR: OD -1.25 DS OS: -1.00 -0.50 x 145
- 3 year regression visit
  - MR: OD -1.25 -0.25 x 180 OS: -1.00 DS

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Patient KL

- 08/09/11
- MR OD -1.00DS OS -0.50 -0.75 x 135
- Fit in soft colored lenses
- 08/2013
- MR OD -0.75 -0.50 x 060 OS -0.75DS

7 years myopic Progression: -0.25D each eye

- 06/19/14 (19 yo)
- MR OD -1.25DS OS -1.25DS (Fit back into OK)

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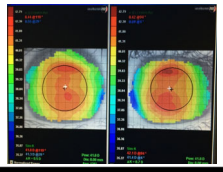
Patient EB

- 10 yo female
- OD -1.25 -0.50 x 055; 41.75@180 /43.25@090
- OS -1.25 -0.50 150; 41.75@180 / 43.00 @090
- Fit in Emerald VST



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Patient EB

- 1 year regression visit
  - MR: OD -1.25 -0.25 x 050 OS: -1.25 -0.50 x 140
- 2 year regression visit
  - MR: OD -1.75-0.50x063DS OS: -1.50 -0.50 x 150
- 3 year regression visit
  - MR: OD -2.25 DS OS: -1.25-0.75 x 140 DS

***3 year Myopic Progression OD -1.00D OS: pl*

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Patient EB

- 1 year later:
  - Presents wearing Emerald lenses
  - Refraction: OD pl OS pl -0.50 x 180
  - No further progression OU
  - Continues wearing lenses

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Patient EA

- Presented asking about lenses for myopia control
  - 11 yo female
    - 2011 -1.75 OU
    - 2012 -2.25 OU
    - 2013 -2.75 -0.25 x 010 / -2.75 -0.75 x 010
- Presented both SBF and OK options…

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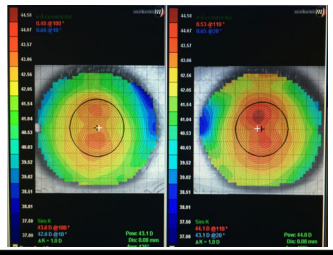
Patient EA

- Patient elected to wear OK lenses
- Fit in Paragon CRT lenses



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Paragon CRT

- Standard diameter 10.5
- Standard power +0.50
- Return Zone Depth .450 – .550mm
- Landing Zone Angle 31-35

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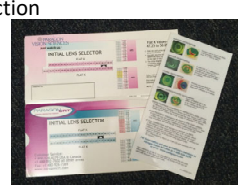
Paragon CRT

- More practitioner control than Emerald Lens
- Determine initial lens:
  - Spherical portion of refraction
  - Flat Keratometry reading



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Summary

- Both Soft Bifocal Contact Lenses and Orthokeratology can reduce myopia progression
  - Can be easily fit on young patients
- 0.01% Atropine
  - $80 - $135.00 10 ml bottle (can keep for 2 months)

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Summary

- Start educating patients on myopia control
- Don't be afraid to fit kids in contact lenses
- Educate about Atropine
- Practice Builder

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