Myopia Control Basics
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Myopia Control
- Why you should do it:
  - Investing in your patients long term eye health
  - Parents will see you as an up-to-date and proactive eye care provider
  - KIDS LOVE IT!
  - It’s proven, and profitable

How does myopia get worse?
- The basics: We are not really sure...
- What we know:
  - Increasing near-sightedness is associated with a longer axial length and higher K values
  - Higher myopia = longer axial lengths
  - Longer axial lengths = pathological risks

How does myopia get worse?
- A common thought:
  - Children with accommodative lag at near may be at risk for myopia progression
  - Esophoria at near is also considered a risk
  - Foveal hyperopic defocus is the driving factor in these studies
  - If this was the case, studies utilizing PALs should work

How does myopia get worse?
- Another thought from late 1990s:
  - Mechanical tension between the ciliary body and choroid restricts equatorial growth of the eye in myopic and emmetropic children
  - Results in increased effort when focusing at near
  - Accommodative lag is a consequence of progression, not a cause.
How does myopia get worse?

- **Peripheral refractive error:** The difference in power between the peripheral and central retina
  - Can be used to describe ocular shape
  - Myopic eyes are more hyperopic in the mid-peripheral retina, creating a more prolate eye shape
  - Accommodation also causes a more prolate eye shape
  - The mechanical tension theory and the peripheral hyperopic defocus theories may tie together

Summary

- Accommodative lag probably has something to do with it
- Hyperopic defocus is involved, but we aren’t sure if it’s peripheral or foveal
- We know that breaking the accommodation strain and viewing objects at distance helps control progression

Myopia Gets Worse.... So What?

- High levels of myopia are associated with:
  - Higher rates of microbial keratitis due to contact lens over-wear and abuse
  - Loss of best corrected visual acuity due to ocular disease associated with high myopia
    - Glaucoma
    - Myopic Macular Degeneration: Retinal neovascularization leading to bleeding and scarring
    - Retinal Detachments

Risks Associated with Myopia Progression

- **Parental myopia (as of 2014 study)**
  - Rates of myopia in 12-14 year old kids
    - 6% (emmetropic parents)
    - 18% (one myopic parent)
    - 32% (both parents myopic)
  - Rates of myopia in older children (up to age 17, Australian study) = 42-59%
  - YIKES!
Risks Associated with Myopia Progression

- Parental myopia (as of 2016 study)
  - 3 groups
    - 2 myopic parents, one myopic parent and no myopic parents
  - Found females with one or both parents most at risk

Why the epidemic?

- What has changed since we were kids?
  - Jones et al, 2007, showed that children who had increased participation in outside activities exhibited a reduction in myopia progression versus their less active counterparts.
  - The Sydney Myopia Study (Rose et al, 2008) also found a protective effect from greater amounts of exposure to outdoor lighting.

Light-Dopamine Cycle

- How does it work?
  - Mechanisms are poorly understood
  - Possible molecules involved in increased myopia
    - Dopamine: progression noted when release is reduced, which occurs in dark conditions
    - ZENK: protein that is also inhibited in dark conditions and myopia progression is noted
    - Vitreal dihydroxyphenylacetic acid (DOPAC): lack of luminance contributes to high K's and longer AL in baby chicks

Myopia Control Confusion

- True or False?
  - Undercorrecting a child in glasses will also help slow myopia progression
  - Relevance — I get resistance from parents when I want to change their glasses prescription to a higher amount, especially in Asian families
  - Asian families in my practice area are VERY aware of the "myopia epidemic" and want to be proactive

Socioeconomic factors

- Higher prevalence of myopia is seen in groups with higher household incomes, higher education levels and occupations with more near work
  - "Professional and white collar jobs"
- Children of these groups also tend to be more myopic as well
**Myopia Control Confusion**

- **FALSE:**
  - Under-correction in glasses actually resulted in an **INCREASED** rate of progression compared to correct Rx single vision glasses.
  - Some studies indicate PALS are not clinically effective in slowing myopia, even in patients with a lag of accommodation and near esophoria. Other studies show there is maybe some control.


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**Myopia Control Confusion**

- Is my kid at risk?
  - European children progressed at -.55 Diopters per year and Asian students progressed at -.82 Diopters per year. Younger children and females progressed faster.


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**How do spectacles and SV contact lenses potentially increase the risk of myopia progression?**

- "Hyperopic defocus"
- "Hyperopic defocus"

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**What are my options to control myopia progression?**

- Glasses
- Corneal reshaping contact lenses
- Soft multifocal contact lenses
- Lifestyle changes
- Pharmaceuticals

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Vision Research Institute (VRI) at Ferris State University’s Michigan College of Optometry has recently launched myopiacontrol.org.

This new site will serve as a central gateway to information on myopia and myopia prevention for eyecare practitioners around the globe.

The prevalence of myopia appears to be increasing at alarming levels and awareness among the eyecare community is important, along with being up to date on the most current investigations and clinical methods to control its progression.

The site features:
1) periodic interviews with international experts
2) recent publications
3) a research archive

This site is funded by an educational grant from Paragon Vision Sciences.
Spectacles for Myopia Control?

- Most promising spectacle studies are in children utilizing an executive style bifocal vs standard flat top.
- Executive bifocals with base-in prism may control myopia progression even more, but many studies show no statistical difference between the two groups.
- Some studies showed up to 39% reduction in progression.

New product: MyoVision glasses that cause peripheral defocus (No significant data to date)

Orthokeratology to Control Myopia Progression: A Meta-Analysis

Average = 50% reduction in AL vs controls.
Myopia Control

How to bring it up?

Easy in... Parent driven: 
- “Is there anything we can do to keep Timmy’s prescription from getting worse?”

Another soft approach: 
- “I see that Timmy’s prescription has increased from last year. There are a couple options for keeping his eyes from getting worse, would you like to hear about them?”

Power of suggestion: 
- “Timmy’s eyes have increased from last year. Based on his age and current prescription, he is on track to progress to significant near sightedness by his mid-late teens. There are treatments to control the progression of his prescription, and I would encourage you to consider this option.”

Getting Started

Parent / Patient Education
- Risks:
  - Mild: CL awareness and discomfort
  - Moderate: Corneal abrasions due to miss handling lens, or too shallow of a lens fit
  - Severe: Microbial keratitis causing loss of BCVA

- Benefits:
  - Control progression of near sightedness
  - Reducing risk of ocular disease related to high myopia
  - No lens on eye during day time = less likely to lose
  - FDA Approval on most designs up to -6.00

Initial Evaluation

Consultation visit
- Visual acuities
- Manifest refraction
- Slit lamp exam to rule out eyelid/corneal anomalies that would limit success
- Baseline topography and keratometry readings

Initial Evaluation

But what if I don’t have a topographer?
- While you could be fairly successful with ortho-K without a topographer, if you want to be a great fitter, a topographer should be utilized
- Key problem solver
- More important in ortho-K than scleral lenses

Topography findings

Which one of these is going to have a better chance at success with a standard OrthoK lens? Topography can dramatically help with trouble shooting and modification to lens design

Good Candidates

- Less than 4D of myopia
  - Why is FDA -6.00 approved?
- Less than 1D of corneal astigmatism
- K’s in mid 40’s, higher with high myopia
- Kids, as well as parents, are ready for the process
Fitting Ortho-K Lenses

- You need refraction and K’s to pick a lens (from dispensing set, or order from lab)
- Once lens is selected, place on eye
- Over-refraction: Small amount of plus; +0.50 to +1.00
- Proparacaine is OK ...... after parental consent!

Fit:
- Area of applanation should be larger than pupil, and centered over line of sight
- Pay careful attention to the borders of the area of touch, are they really distinct? You might be too shallow - watch for central staining at follow up.
- Lens should move on blink ... just a little!

Fitting Ortho-K Lenses

Fit:
- Centered, circular ring around pupil, should be larger than pupil size
- Mild edge lift
- “Fuzzy” treatment margins

Care and solutions
- Multipurpose: Simplus and Unique pH
- Artificial Tears: Preservative Free options
- A and R training
- Kids are fearless!
- Removal tools

Follow up care for OrthoK
- Topography
- Visual acuity
- Manifest refraction (sphero-cylindrical?)
- Slit lamp corneal evaluation - corneal staining specifically
- CL evaluation: fit and OK
- Make adjustments as needed

How can we manipulate the OrthoK fitting to improve outcome?
- 2 ways:
  - Base Curve:
    - ONLY CHANGE THIS IF YOUR OVER-REFRACTION IS NOT +1.00! (Flatter if you need more plus)
  - Sagittal depth:
    - Shallower lenses will give more treatment zone
    - Deeper lenses will relieve corneal staining, aid in centration and reduce flexure
- That’s it! So just ask yourself... is my over-refraction acceptable? If yes, then the only thing you need to change is the sagittal depth. Woo!
Analyzing the topography

- Incomplete treatment zone
- Cylinder in treatment zone
- Decentered treatment zone

*Cylinder that wasn’t there pre-treatment

What lenses should I use to get started with Ortho K?

- Paragon CRT
  - In office dispensing set
  - SureFit sets are great for practices without a dispensing set
  - Lenses are predictable and easy to understand
  - Paragon is not the only kid on the block
  - Many, many labs have FDA approved options, talk to your lab first before opening another account

Paragon CRT Breakdown

Example

- Average lens: 3 curves
- 7.9 - 550 - 34

But what does this mean?

BC: amount of correction
Going for +1.00 OR!

RZD: Amount of reverse curve
More reverse is more depth

LZA: Landing zone angle, similar to RZD at lesser effect
LZA: “less is more”

Do orthoK lenses affect eyelid structure or physiology?

- After 24 and 36 months of orthokeratology lens wear:
  - 2% percent of patients showed decrease in number of viable meibomian glands
  - 3.5% showed “ocular surface and meibomian gland changes”
  - Almost all showed papillary conjunctival changes
  - No increase in interleukins or MMP-9

Soft multifocal and orthokeratology contact lenses

- How do they work?
  - Main science behind these treatments is limiting / eliminating the stimulus for the peripheral retina to drive eyeball lengthening
  - “Peripheral retinal confusion”

How soft multifocal and orthokeratology contact lenses help control myopia progression?
Soft Multifocal Contact Lenses for Myopia Control

- Data in the last few years is very promising: Rates of myopia control are nearing similar results to corneal reshaping
- What type of multifocal?
  - 2 theories
    - Center distance, creates optical system similar to ortho-K
    - “Any add, any place” will create enough retinal confusion to decrease myopia progression**

**More data supporting center distance MFs

Soft Multifocal Contact Lenses for Myopia Control

- What do I need to know about prescribing?
  - Used for any prescription
  - Studies show higher add powers have better control over myopia progression
  - I order in +2.00 adds and +2.50 adds, starting with the higher add first and dropping only if VA is significantly reduced or the child comments on blurry vision.
  - Don’t forget to vertex!

Soft Multifocal Contact Lenses for Myopia Control

- Make sure parents are aware of the goal = to control myopia progression
- VA’s may be a soft 20/20 or 20/25 due to optics
- What about high or complex Rx’s?

Soft Multifocal Contact Lenses for Myopia Control

- Custom Soft Contact Lenses
  - Usually a quarterly modality
  - Great for really high myopes and/or those with higher amounts of astigmatism, or design custom diameters for smaller eyes.
  - Good exchange policies
  - Sometimes CHEAPER than a year supply of monthly disposables

Quick side note on new data:

- Does oxygen have anything to do with it?
  - A CLAY study from 2015 showed that hydrogel contact lens wearers required changes to their prescription more often than silicone hydrogel wearers
  - Other factors included children between ages 8-19 and a shorter time period to their first refractive change
  - CLAY = Contact Lens Assessment in Youth

Custom Soft Contact Lenses

- Some are available in Silly materials
- Great for myopia / astig outside successful range of standard disposables

quick side bar...
How effective are soft multifocals?

- Similar to orthokeratology - up to 50% control of myopia progression!

You are not providing a lesser service by choosing soft lenses!

How do soft multifocals affect a child’s vision?

- High and low contrast VAs were reduced upon initial insertion of high add, distance center soft multifocal contact lenses
- At the two week assessment, high contrast VAs were ‘less significantly’ reduced
- QoV scores (subjective testing) did not improve at the two week mark
- May be worth testing more than just high contrast VAs

Thoughts to remember:

- This is a specialized service and you will be seeing the child 3-4 times yearly
- Must set up a yearly fee to cover all visits
- Should be more than your multifocal fitting service cells.
- Because there is no medical diagnosis code, topography cannot be billed to insurance

Lifestyle Changes

- Spend more time outdoors
- No reading in the dark!
- Change position from down gaze to up or neutral gaze

iPad and other technological devices: limit the use because of accommodative aspect

Pharmaceuticals

- Atropine
  - Most widely studied
  - Supported by data to control progression
  - Many side effects: light sensitivity, blur at near
- Pirenzipine
  - Some studies report up to 90% control with less side effects than Atropine
  - Not yet available in USA
- 7-methylxanthine (oral treatment)
  - Slows growth of axial length from 0.52mm per year to .22mm per year
  - Safe to use long term, studies have been done through the late teens

Atropine studies

- 0.5%
  - Baseline progression: 1D per year
  - Progression after one year: 0.1D per year
  - Side effects: light sensitivity, focusing problems and headaches
- 1.0%
  - Great control of myopia progression
  - Poor compliance due to side effects
  - Need for bifocal glasses due to inhibition of accommodation
Atropine Studies

Low dose atropine: 0.01%
- Study of acceptance of side effects
- College age students tested for 1 week
- Good response to drops with minimal side effects

0.01% atropine
- Kids ages 6-12
- Pupil size increased by 0.7mm
- Accommodation decreased by 1.5 D
- Subjective symptoms minimal

0.01% atropine
- 60 kids, ages 6-15 for a 1 year study
- Treated group: progression of 0.19 / year
- Control group: progression of 0.69 / year
- 3 treated children and 4 controls exhibited rapid progression of myopia, >1.00D / year
- Often stronger concentrations may be needed for rapid progression myopia

Other options

Pirenzepine
- Same category as atropine, but only works on M-1 receptors, which are less concentrated in iris and ciliary body
- Less side effects on vision and light sensitivity
- Slightly less effective than atropine (?)

7-methylxanthine
- Taken by mouth
- Study in rabbits
  - One eye form deprived, the other open
  - 1/2 group given 7MX, other given saline
  - 7MX group progressed -0.21 D compared to -1.10 D during study period

How often should they be seen?
- My follow up schedule if everything is working well
  - 2-4 days
  - 2 weeks
  - 3 months
  - 6 months
  - 1 year
Follow up care tid bits

- Continue to educate your patients and their parents about lens care and safety
- I recommend Progent cleaning every 6 months to keep lens as clean as possible
- REPLACE THE CASE!!! (no hello kitty cases)

Follow up care tid-bits

- Biofilms on lenses don’t necessarily cause infection, but can cause mild surface inflammation, which can lead to blur
- If the lens has been successful for several months and now the VA has changed, consider Progenting prior to changing lenses and inevitably chasing your tail.

Myopia Control Summary

- Don’t be afraid to get started
- Consultants are very helpful
- It’s an investment in your young patients!

Thank you!

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Any questions?