

Cutting Out Surgery for the Management of Refractive Error

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TOA 2024

Financial Disclosures

- Co-Founder Dr. Contact Lens
- Co-Founder TechifEYE
- MAB- OSRX Pharmacy
- Principal Investigator- STAAR Study
- Medical Advisory Board- Visus
- Speaker Bureau- Coopervision
- PAC- Johnson & Johnson

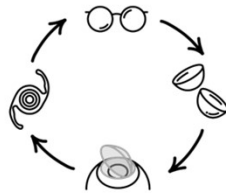
Goals

- History of orthokeratology
- Corneal Topography and how to set yourself up for success
- How to Prescribe Ortho k

4:00 on Friday

The Cycle of Refractive Error

- Pediatrician
- First pair of glasses
- Fitted with contacts (if right for the child)
- Interested in Refractive Surgery
 - LASIK (SMILE)
 - PRK
 - ICL
- Refractive Cataract Surgery
- Retinal specialist

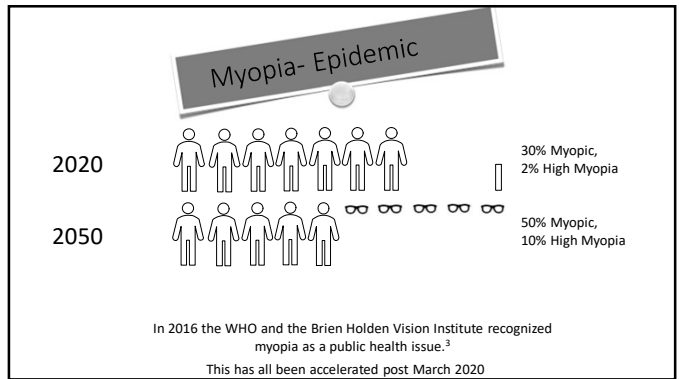
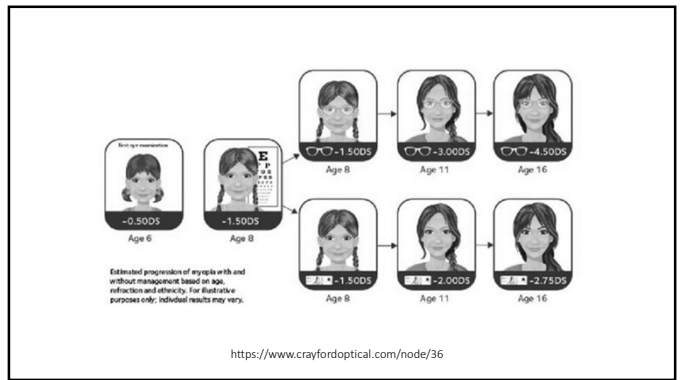
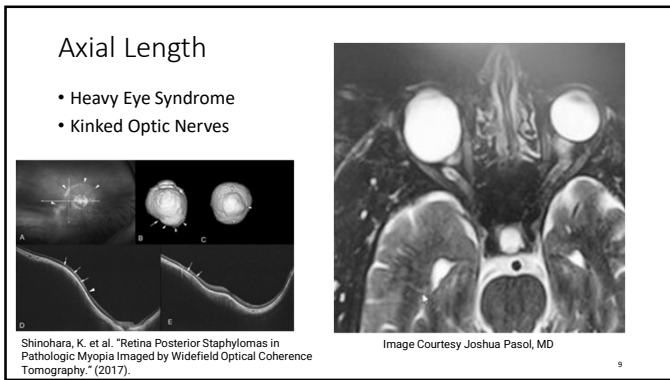
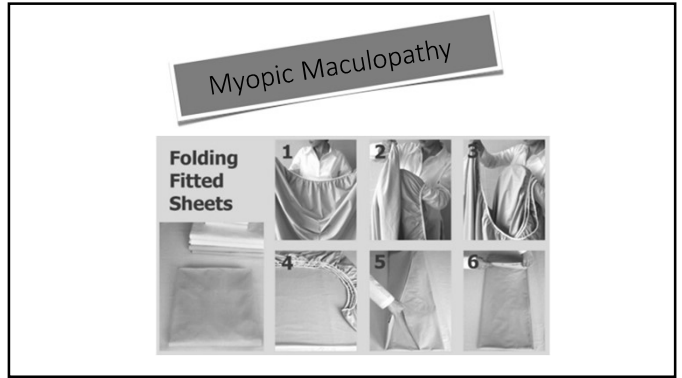


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The Visual System



Photo Courtesy Joshua Pasol, MD



History of Our Profession Against Disruption

1970's
1978 FDA Approval

1980's
1999 FDA Approval

The Process of Evolution

Adjusting to something new

Our Journey, Our Patient Journey, Our Parent Journey

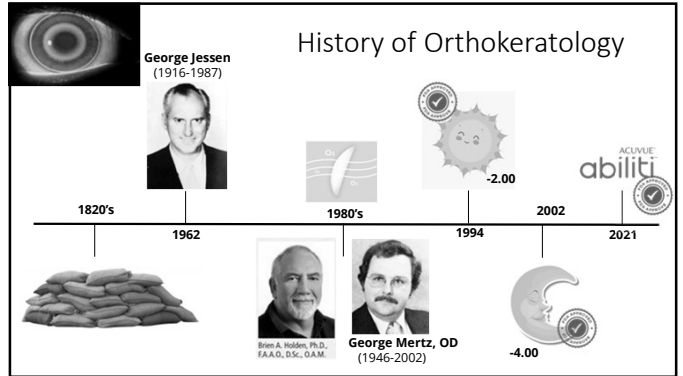
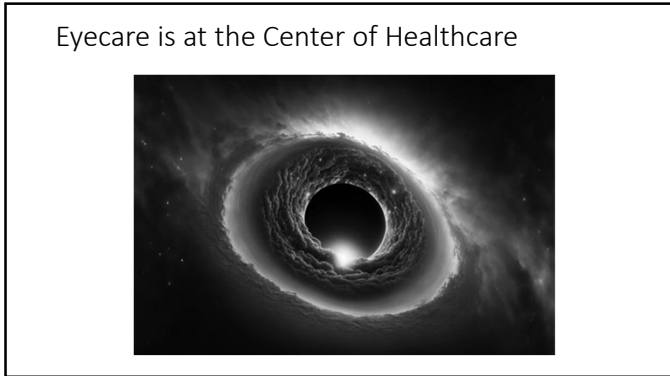
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What Types of Patients Do You Want to See

- Answering the phone
 - How to present fees
 - Price shopping
- Your website
- Your office
- Word of Mouth

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ORTHO **KERAT** **OLOGY**
Straight *Cornea* *Knowledge*

A non-surgical, topographical approach to eliminate refractive correction

The History of Orthokeratology

- Contact lens wear can produce changes in corneal curvature
- Planned temporary reduction in myopia by the wearing of flat-fitting rigid contact lenses
- Early 1960's "orthofocus" technique
 - Jessen discussed fitting lenses flatter than K by the amount needed of myopia corrected

Early Ortho-K

- Fit an RGP flat on the cornea which led to problems with centration and poor and variable outcomes.

Ortho-K Today

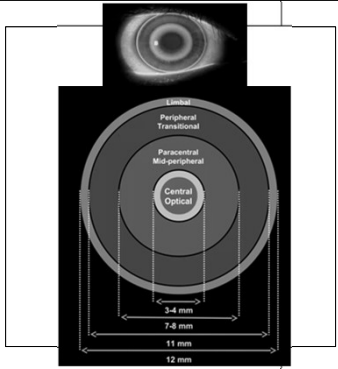
- Empirical Method
- Trial/Diagnostic Fitting
- Topography Based Designs

Ortho-K

- Gas permeable materials
 - Limit corneal edema
 - Cornea is reshaped as the patient sleeps
 - Without correction through the day
 - Reduction is temporary, worn on a nightly basis to continue the effect

Ortho-K

- Central
- Paracentral
- Peripheral
- Limbal

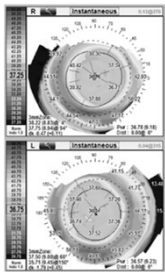


Advantages Over Surgery

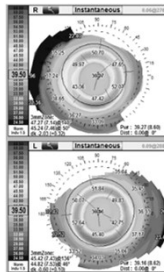
- Reversible
- Costs Less
- Age appropriate treatment for changing eyes
- Quick Results
- Teaches responsibility
- Freedom from day time glasses or contacts

Which is which?

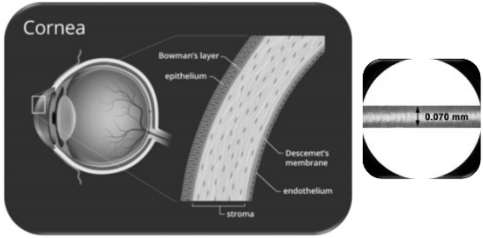
LASIK



ORTHO-K

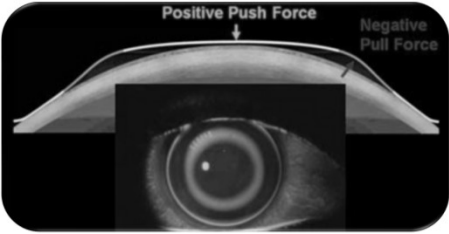


Ortho-k and the Cornea



Ortho-K

Creates unequal profile of tears creating a positive (push force) in the center of the cornea and the negative (pull force) in the midperiphery



- NaFL not visible if tear lens is <20 microns

LASIK vs Ortho-k Anatomically

Flap = 90-110 microns

50 microns → 8-10 microns = -5.00D

-5.00 Myope = 75 microns

-9.00 Myope = 135 microns

235 microns

500 microns

Orthokeratology (OK) for Myopia Management

- Corneal GP molds cornea to correct central refractive error while leaving peripheral myopic blur
- Myopic blur acts as a putative cue to slow the progression of myopia (Kakita et al, 2011; Smith et al., 1994, 2013)
 - Center Distance MF Soft Lenses
- OK slows growth of the eye by 45%

How does Orthokeratology Work?

- What happens to the cornea during Orthokeratology?
- Human Epithelium
 - 50 μm
 - 75% water content
 - n = 1.376
- Connected by tight junctions, cadherins, and gap junctions

How does Orthokeratology Work?

Reverse Curve Base Curve Reverse Curve

Control 4 hours Myopic OK

How does Orthokeratology Work?

How Does Orthokeratology Work?

- Multifactorial
 - Cellular compression with intracellular fluid transfer
 - Increased Cell Mitosis
 - Increased Cell Retention
 - Localized Stromal Remodeling

Ortho-K

- Refraction
- HVID
- K's
- Topography

Contemporary Orthokeratology Lenses Myopia

- Diameter
 - 90 to 95% of Horizontal Visible Iris Diameter (HVID)
 - 11.8mm x 0.95 = 11.00 mm
- Material
 - High-Dk needed for overnight wear
 - Oxygen Transmissibility (Dk/t) 87 (Holden and Mertz, 1984)

Orthokeratology (Ortho-K)

Topography

Placido Disc

- The closer the mires, the steeper the axis
- The wider the rings, the flatter the axis.

Overlay of Mires

Capturing Best Topography

- 1 Capture 4-6 baseline maps
- 2 Assess maps: delete poor maps
- 3 Identify your best map
- 4 Measure OVID (Oblique Visual Iris Diameter)

Axial Maps (Sagittal) → Power

- Describes the surface relative to the optical axis
- General view of the corneal contour
- Highly dependent on patient fixation
- Central information

Tangential Maps (Instantaneous or True Curvature) → Fit

- Describes the corneal surface independent of the optical axis
- Shows small localized changes of the cornea
- Peripheral information

Axial difference map:

- size of treatment zone and change in refractive power

Tangential Difference Map:

- centration of treatment zone

Normal Cornea

- Prolate Ellipse
- Eccentricity (e Value)
 - Rate of corneal flattening moving away from corneal apex
 - 0 → sphere
 - Average is 0.5 to 0.6 (Q = -0.4 to -0.2) along horizontal meridian

Corneal Contour

- The human cornea is Aspheric

Corneal Eccentricity

High e (flatter alignment curve)

Low e (steeper alignment curve)

<https://www.clspectrum.com/issues/2017/march-2017/the-anatomy-of-a-modern-orthokeratology-lens>

Alignment Curve

- Lower e value → K Steeper
- Higher e value → K Flatter

Toric Alignment Curve

- 30 μm difference at landing chord (Kojima et al, 2016)
 - ~8.00 to 9.00 mm
- Limbus to limbus astigmatism
- May occur in low astigmatism

Prescribing Orthokeratology

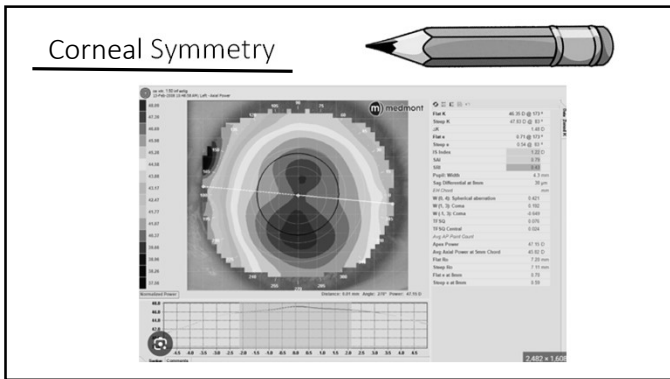
Designing the Lens

Where to begin?

Empirical Fitting	Fitting Sets	Topography Guided Fitting
<ul style="list-style-type: none"> • Manifest Refraction • HVID • Topographer/Keratometry Values 		

Ortho-K Candidates

- ~7 or older
- -1.00 to -4.00 (FDA Approved up to -6.00)
- Myopia > Astigmatism
- Cyl < -0.75 WTR central also great option if cyl is >>-1.00
- K's between 41-45

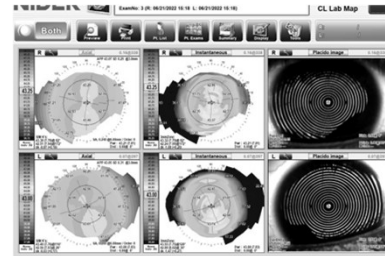


1 year, 2 year, 3 year follow up

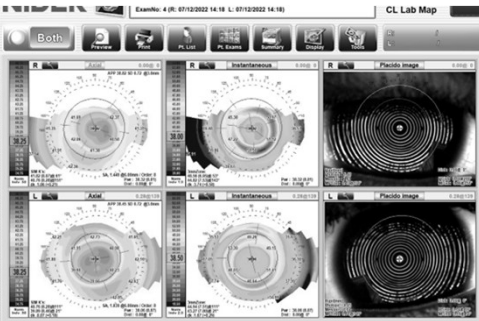
	Entering Rx	1 st AL	Year 1	AL	Year 2	AL	Year 3	AL
OD	-4.75	25.19	pl	25.25	pl	25.73	pl	25.62
OS	-4.50	25.46	pl	25.49	pl	25.88	pl	26.10

11 year old

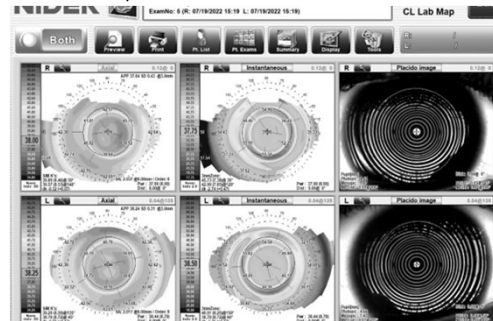
- OD: -7.50 AL: 27.20
- OS: -7.50-0.50x060 AL: 27.35



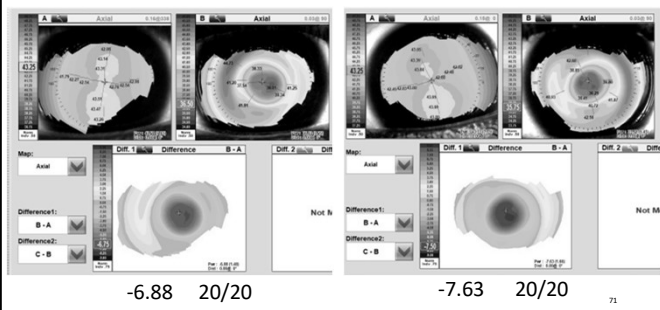
1 Day Map



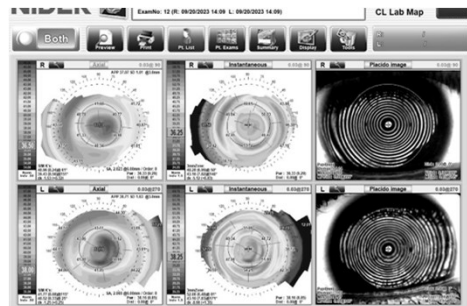
1 Week Map

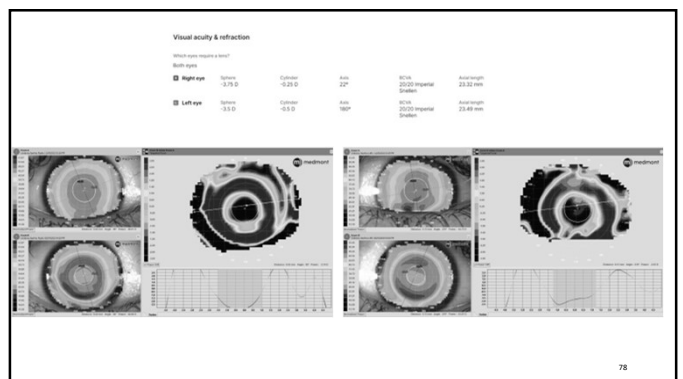
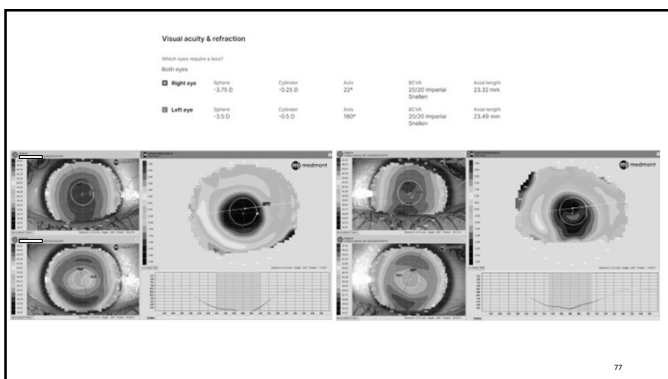
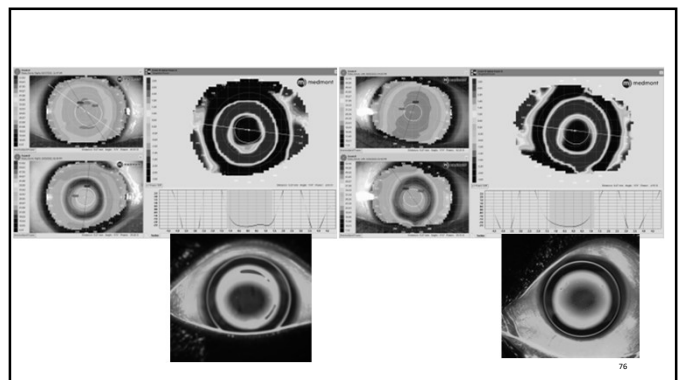
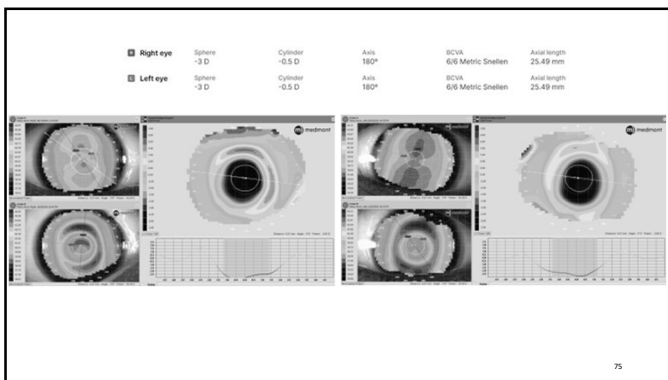
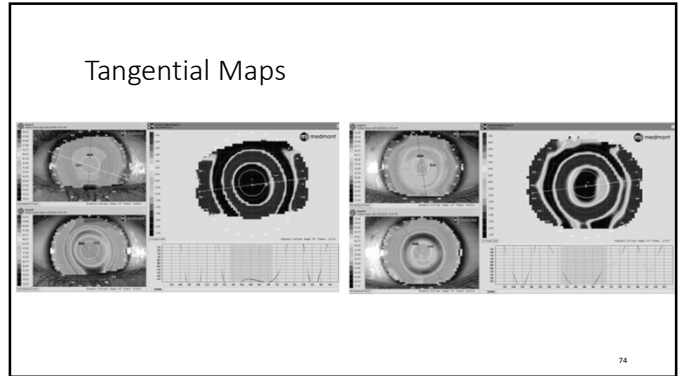
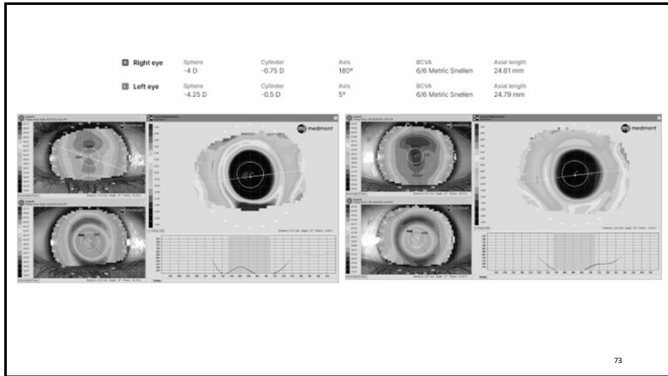


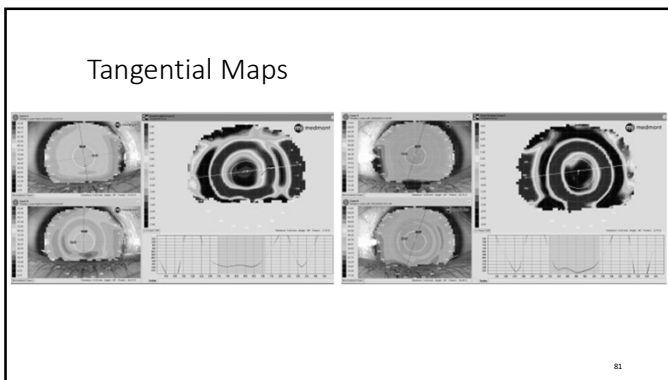
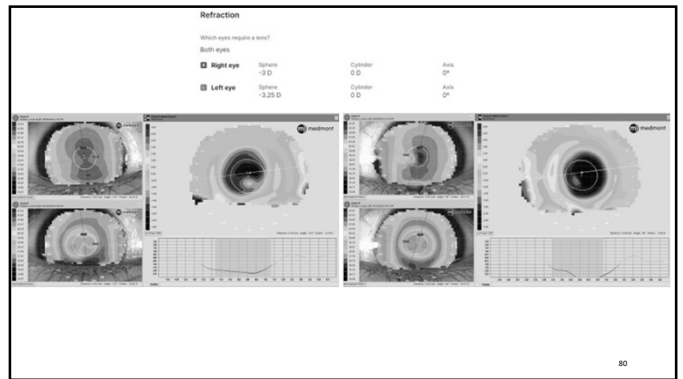
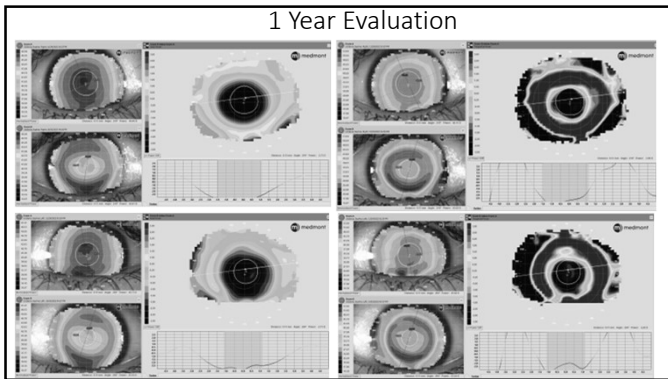
Difference Maps



1 year map







Ortho K Evaluation Schedule

- Year 1 follow up/evaluation schedule
 - 1 day
 - 1 week
 - 1 month
 - Every 3 months
- Year 2 follow up/evaluation schedule
 - Annual visit (we replace lenses every year no questions asked)
 - Every 6 months if progression has slowed to <-0.50D

Lens Discontinuation

- Refractive error will regress towards baseline
 - ~half of myopia reduction will be lost after 24 hours
 - 90% within 72 hours

How does myopia control lead to better LASIK outcomes?

- Avoid complications of high myopia
- Less corneal tissue removal
- Safer procedure
- Better visual outcomes
- Overall better experience

LASIK Treatment Considerations

- Approx. 16-18 microns for each Diopter
- Corneal Flap: 90-110 microns (Adjustable)
- Goal is to only treat <40% of cornea
- Ideal residual bed is >300 micron
- Best LASIK candidates are -1.00D to -6.00D

Flap = 90-110 microns

50 microns

235 microns

500 microns

-5.00 Myope = 75 microns

-9.00 Myope = 135 microns

Visian Implantable Collamer Lens (ICL)

- Parameters:
 - Myopia: -3D to -20D
 - Astigmatism: -1D to -4D
- Need 2 LPIs prior to insertion
- New EVO + design (clinical trials)
- Removable
- UV protection

Patient Case CG

OD: -8.00 -2.25 X 170
Pach: 557

OS: -8.00 -3.00 X 175
Pach: 541

Patient Case CG

OD: -8.00 -2.25 X 170
OS: -8.00 -3.00 X 175
Pach: 557/541

6.5 OZ / 100 microns flap

- Tissue Altered: 42%/ 44%
- Residual Stromal Bed: 326/302

6.0 OZ / 100 microns flap

- Tissue Altered: 37%/ 38%
- Residual Stromal Bed: 355/ 338

By modifying the OZ this patient was still able to undergo LASIK

Patient Case RM

OD: -6.00 -1.25 X 178
Pach: 480

OS: -5.25 -1.75 X 170
Pach: 469

Patient Case RM

OD: -6.00 -1.25 X 178
OS: -5.25 -1.75 X 170
Pach: 480/ 469

PRK OU / 6.5 OZ / 58 micron flap

- Tissue Altered: 29%/ 31%
- Residual Stromal Bed: 339/ 326

LASIK OU / 6.0 OZ / 100 micron flap

- Tissue Altered: 38%/ 39%
- Residual Stromal Bed: 296/ 287

Due to thin pachis this patient was a better candidate for PRK

Patient Case PG

OD: -10.50 -3.50 X 180
Pach: 512

OS: -9.50 -3.75 X 179
Pach: 515

Patient Case PG

- OD: -10.50 -3.50 X 180
- OS: -9.50 -3.75 X 179
- Pach: 512/515

LASIK OU

- 6.0 OZ / 90 micron flap
- Tissue Altered: 44%/ 42%
- Residual stromal bed: 287/ 298

ICL OU

- Two Laser Peripheral Iridotomies in each eye
- Corneal Tissue Unaffected
- Uncorrected VA at 1 week PO: 20/20 OD, OS

How Referrals Continue

- Pediatricians
- Pediatric OMD's
- Lasik Surgeons
- Cataract Surgeons
- Retinal Specialists
- Other OD's
- VT Clinics
- Moms (PTO)
- School Nurses

When to Consider Refractive Sx?

- Ocular Maturity & Refractive Stability
 - No change in MRX of more than -0.50 in approx. 1 year
- Best time could be after 1st year of College
 - F/u after 1st semester & consider washing out ortho K lenses
 - Serial Topographies

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MGD and Kids

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Setting Yourself and Your Patients up for Success

Patience because you already have patient's

- Handouts/Contracts
- Equipment
- Referral Letters
- Compounding Pharmacy
- Fitting Sets, Orthok Lab

The Pitch

- ▶ You have a myopia clinic already
... Take the time and go after it
- ▶ Discuss pros and cons of treatment
- ▶ Don't get discouraged by a no
- ▶ Have both parents present at consult

**Setting Your Patients and Yourself
Up for Success!**



A Goal Not Written Down is Just a Wish

- Challenge yourself to be 1% better than you were coming to this meeting
- Team Meeting- they want to know where you were and what you learned
- 1 year plan broken into 90 day focused sessions
 - Education-
 - Fee structure, staff training
 - Website, brochures, welcome kits
 - Find your tribe

Take Aways

- Take great maps before you start
- Start with easy cases to gain knowledge and confidence
- Set realistic expectations
- Don't limit ortho-k to your pediatric population
- Look at and treat the tear film



The Next Generation



Thank you!

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