INTRODUCTION TO ORTHOKERATOLOGY

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Introduction
Orthokeratology

- Temporary correction of refractive power
- Use of rigid gas permeable lenses
- Corneal reshaping, Corneal Refractive Therapy (CRT), Vision Shaping Treatment (VST)
Poll Q1
History & Evolution

Orthokeratology

- Early 1960s
  - “Orthofocus”
  - Average reduction 1.00D-1.50D with large variability

- Limitations
  - Lack of long term data
  - Keratometry readings only
  - Use of PMMA lenses
  - Effects take weeks to months
  - Multiple lens treatments
Modern Day Ortho-K

• FDA approval: 2002
  – Overnight wear and correction of myopia
• Materials
  – Hyper-DK material for overnight wear
• Myopia control
• RGP Design
  – Flatter conventional GP vs. reverse geometry
• Use of corneal topography

New England College of Optometry
Modern Day Ortho-K
Reverse Geometry Design

- Multi-zone design
  - 3 or 4 curve system
  - secondary curve steeper than base curve
- Improved treatment centration
- Improved predictability

Reference: John Mitford: Orthokeratology Principles and Practice 2004
Mechanism

- Central corneal thinning and midperipheral thickening

- Changes involve fluid forces of the \textit{tear film} and lid pressure from “closed eye environment”
Patient Selection

• Children
• Adults
  – Athletes/Active
  – Presbyopia consideration
• Motivation
• Compliance
• Expectations
  – Visual, comfort
• Time and $$
Patient Selection

• FDA approval for Paragon-CRT
  – **Sphere Power:** Upto -6.00D myopia
  – **Astigmatism Power:** Upto -1.75D of cylinder

• Best success with lower baseline levels of myopia and low with-the-rule astigmatism

• Importance of Topography
  – Astigmatism Central vs. limbal to limbal
Patient Selection

Poor Candidates

- **Myopia**
  - >6.00D
- **Astigmatism**
  - >1.75D
  - ATR >0.75
  - *Lenticular cyl* >0.75
- **No corrective devices**
- **Amblyopia**
- **Non-compliant**

- **Corneal irregularities**
  - Disfigured
  - Keratoconus
  - Dense keratitis
  - Severe Dry eye
  - EBMD
  - Acute inflammation
Patient Selection

Consultation Exam

1. Manifest Refraction
   - Cycloplegic
2. Baseline Topography
   - Eccentricity
3. HVID
4. Pupil diameter
5. Lid position/tension
6. Corneal check
Patient Education

Benefits vs. Risks of Orthokeratology

- Reduction of myopia
- No daytime correction needed
- Alternative to refractive surgery
  - Children are not candidates for LVC
- Reversible/Temporary
- Myopia control
  - Not yet FDA approved
- Safety*
  - vs. contact lenses and refractive surgery
  - overnight wear
- Comfort
- Induced aberrations
Reviewing Expectations

- **How long does the treatment take?**
  - Rate of treatment varies patient to patient
    - Refractive error correction
  - Approximately 10-14 days
  - Recommended Time worn: 7-8 hours nightly
    - Do not wear for corrective reasons, this is a reshaping lens
Reviewing Expectations

• **Visual expectations**
  – After 1 night, must wear correction all day
  – For 1 week, must wear correction late in day
  – 2 weeks to 1 month, no correction all day
  – Plan for blurry vision
    • Glasses when blurry distance vision
    • Soft disposable contact lenses
• Glare/halos, especially at night
Case History

• 10 yo Female with progressive myopia referred for orthokeratology treatment

• Medical Hx: unremarkable

• Ocular Hx:
  – Bilateral Myopia
    • Progressed >1.00D in the past 6 months

• Seasonal allergies, takes Zyrtec, PRN
Exam Findings

• Uncorrected VA: OD >20/400, OS 20/400

• Lensometry (specs 6 months old):
  – OD: -1.50-0.25x100 VA: 20/50
  – OS: -1.50 sph VA: 20/30

• Cycloplegic Refraction
  – OD: -2.75-0.25x104 VA: 20/15⁻¹
  – OS: -2.25 sph VA: -20/15

• HVID: 11.5mm OD and OS

• Pupils:
  – Dim: 6.5 mm OD and OS
  – Bright: 4 mm OD and OS
Baseline Topography
Poll Q2
Lens Certification

Certification Modules

Certification for Paragon CRT® is not only an FDA requirement, but is an essential part of Paragon's investment in your education and training. Certification ensures that you are on the right path to delivering optimum treatment outcomes to your patients.

The Paragon CRT® training modules can be studied at your convenience. Certification can be completed in as little as 45 minutes.

We wish you the best of luck as you take these first steps towards expanding your practice.

To begin the Training Modules, please fill out form below to create an account.

First Name: ______________________ Last Name: ______________________ Title: ______________________

https://ecp.paragonvision.com/get-certified/
Selecting an initial lens

• Will review:
  – Paragon CRT lenses
    • Choose lens using manufacturer fitting nomogram
  – Empirical vs. Diagnostic Fitting
    – SureFIT

Enhanced
Numbered Lens Diagnostic Dispensing System (DDS)
Initial Lens Selection

- Based on Manifest Refraction SPHERE
- Keratometry Readings
  - Flat and Steep K readings
- Provide Topography to some labs

- **Initial Lens Trialed:**
  - OD: BC 8.6/RZD 525/LZA 33/+0.50 PWR/DIA 10.5mm
  - OS: BC 8.5/RZD 525/LZA 33/+0.50 PWR/DIA 10.5mm
- OrthoK Evaluation:
  - Adequate centration, good movement, apical touch, MP FL pooling, and moderate to light peripheral clearance
- I&R training, solutions training and lens dispensed
- Discuss adverse treatments & to call clinic on presentation
  - Redness, pain, discomfort etc.
Understanding the Lens Parameters

• Lens parameters:
  – Base Curve
    • Flatter than the flat k reading by MRx sphere amount plus an additional 0.5D
  – Return Zone Depth (RZD)
  – Landing Zone Angle (LZA)
  – Lens Diameter
    • Based on HVID
      – Rule of thumb HVID-1.0mm
  – Power
    • Target
Poll Q3
Anatomy of the CRT Design

**Base Curve:** in mm, flatter than K by SR + 0.50 D; OZD = 6.0 mm (fixed)

**Return Zone Depth (RZD):** sag depth, 250 to 600 um (25 steps); 1.0 mm wide

**Landing Zone Angle (LZA):** degrees from horizontal, 29 to 37° (1° steps)
Return Zone Depth – Too Shallow

.500 RZD

.525 RZD
Return Zone Depth - Too Deep

.550 RZD

.525 RZD
Landing Zone Angle

Excessive Edge Lift

Good Edge Lift

Insufficient Edge Lift
Evaluation of Lens Fit

• Centration
  – Lens should cover 90% of HVID

• Fluorescein pattern assessment
  – 4mm central "touch"
  – 1mm paracentral pooling
  – 2mm midperipheral alignment/touch
  – 1mm peripheral clearance

• Movement
Poll Q4
Follow up Schedule

• **Schedule:**
  - 1 day in the AM
  - 7 days
  - 14 days
  - 1 month
  - 3 months
  - 6 months
  - Annual

• **Discuss prior to beginning treatment**
Follow up Visit Protocol

1. Vision (uncorrected)
2. History
3. Topography
4. Subjective Refraction
5. Bio-microscopy (without lens)
6. Apply lenses
7. Vision (corrected)
8. Over-refract (loose lenses)
9. Biomicroscopy (with lens)
   – Assess CL fit
Interpreting the Corneal Topography

Watanabe, R. Contemporary Optometry, June 2004
Poll Q5
Back to Patient
2 week follow up

Uncorrected visual acuity: OD: 20/25 and OS 20/20
Manifest Refraction: OD: -0.75D, 20/15, OS: +0.50 20/20
Evaluation of Lens Fit
Back to Patient
2 week follow up

• Next step:
  – Vision (cl): OD: 20/20- and OS: 20/15
  – Over-refraction: -0.50 sph, 20/15, OS: +0.50 20/20

• Dx: Undertreatment OD
• Plan: Flatten BC by 0.1mm
  – Remember SAM FAP
  – Order Lens:
    • OD: BC 8.7/RZD 525/LZA 33/+0.50 PWR/DIA 10.5mm
    • OS: BC 8.5/RZD 525/LZA 33/+0.50 PWR/DIA 10.5mm
Back to Patient

3 month follow up

Uncorrected visual acuity: OD: 20/20+2 and OS 20/15
Manifest Refraction: OD: +0.25D, 20/15, OS: +0.50 20/20
Central Islands

• **Cause:**
  – Area of central steepening within treatment zone
  – Steep-fitting lens

• Large residual refraction

• **Parameter change:**
  – Decrease return zone (reduce RZD)
  – Decrease sagittal depth
  – Flatten peripheral curve (reduce LZA)
Lateral Decentration

• **Cause:**
  – Against-the-rule Astigmatism
  – Small diameter

• **Parameter Change:**
  – Increase lens diameter
    • 90% of HVID
Vertical Decentration

Superior Decentration

- **Cause:**
  - Flat fitting lens
  - Low sagittal depth
  - With-the-rule astigmatism

- “Smiley-face” on topography

- **Parameter change:**
  - Increase return zone depth (Increase RZD)
  - Steepen peripheral curve (increase LZA)
Vertical Decentration

Inferior Decentration

• **Cause:**
  - Steep fitting lens
  - High sagittal depth
  - With-the-rule astigmatism

• “Frownley-Face” on topography

• **Parameter change:**
  - Decrease return zone depth (Decrease RZD)
  - Flatten peripheral curve (decrease LZA)
Toric Ortho-K

- Toric Orthokeratology
- **Indication**
  - >0.75D corneal astigmatism
  - Poor fitting lens
    - Poor centration
    - Lens instability
- **Use Topography**
  - Corneal vs. limbus to limbus
- **Calculate sagittal differential**
  - Dual RZD
  - Dual LZA

![Eye Images with Topography](image-url)
Biomicroscopy

- Corneal staining
- Lens binding
  - Corneal abrasion
- Rule out infection
  - (-) infiltrate
  - (-) ulcers
  - (-) microbial keratitis
- Iron ring
Safety of OK

• Microbial keratitis:
  – Watt & Swarbrick (ECL 2007): 123 cases of microbial keratitis reported in the literature
  – Bullimore MA, Sinnott LT, Jones-Jordan LA. The Risk of Microbial Keratitis with Overnight Corneal Reshaping Lenses. OVS. 90(9); 2013
  – Pseudomonas
  – Acanthamoeba
  – Other bacteria
  – Fungus

• Cleaning case
Poll Q6
Cleaning and Care

- Hydrogen Peroxide System
  - Clear Care
- Multipurpose System (MPS):
  - Boston Advance – 2 step
  - Boston Simpus
  - Unique PH
- No tap water
- Viscous NP Artificial Tear upon insertion
- Rewetting drops upon removal
REFERENCES UPON REQUEST