Building your Ortho-K practice using GOV lenses

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Charl Laäs  
Chris Eksteen  
Hal Ostrom

Thought of the Day

“Vision is not enough; it must be combined with venture. It is not enough to stare up the steps; we must step up the stairs.”

~ Václav Havel

Fitting Orthokeratology Lenses
Who to fit - Starting

- Hyperopia
  - <+2.00
- Myopia
  - <-4.00D
- Astigmatism
  - <-0.75D
- E value:
  - 0.35 – 0.55
- Normal healthy cornea

Who to fit – With confidence

- Hyperopia
  - <+5.00
- Hyperopia Presbyopia
  - <+4.00, Add <+2.50
- Myopia
  - <-6.00D
- Astigmatism
  - -1.25D
- E value
  - 0.30 – 0.60
- Normal healthy cornea

Who to fit – Master Fitter

- Hyperopia
  - <5.00
- Hyperopia Presbyopia:
  - <+4.00, Add <+2.50
- Myopia
  - <-10.00D
- Astigmatism
  - <-2.25D
- Post Lasik
- Keratoconus
Astigmatism

- Cyl must always be less than half of sphere
- With the rule < -1.50
- Against the rule < -0.75

Empirical VS Systemized Systems

Empirical Fitting Systems

- Manual Calculate
  - Formula
    - BC
      - Mean K (D) - SE (D) - 1.25D (Compression Factor)
      - Diameter: 6.00mm
    - RC
      - 2D to 6 D steeper than central curve
      - 0.6mm to 1.2mm wide
    - AC
      - 0.75D flatter than Mean K
- Proprietary Software
  - Topographer based (Medmont, Wave, etc.)
  - Stand Alone - OrthoTool
Empirical Fitting Systems

• Corneal information or design is given to lab
• Lab designs and manufacture lens
• Lens works
• Or it doesn’t!

Systemized Fitting Systems

• GOV – Global Orthokeratology Vision
• CRT – Corneal Refractive Therapy
• Vision Shaping Treatment (VST) Program
  – “BE Retainer” backed by BE Enterprises
  – “CKR” backed by Eye Care Associates
  – “Contex OK-E System” backed by Contex
  – “DreamLens” backed by Dreimlens
  – “Emerald” designed and manufactured by Euclid
  – “NightMove” backed by Advanced Corneal Engineering

Systemized Fitting Systems

• Pre designed lenses
• Fitted from a fitting chart
• Use Trial lenses to verify theoretical calculations
Does the Px show a central flattening/steepening effect?

Initial lens

Look for Bull’s eye pattern

should not be too flat and tight at the alignment curve zone

should move 1 – 2mm on blink

Does the Px show a central flattening/steepening effect?

Systemized Fitting Systems

General fitting process:

- Initial lens is chosen from chart
- Fit with diagnostic trial lenses and evaluate NaFl pattern
  - Look for Bull’s eye pattern
- Initial lens
  - should not be too flat and tight at the alignment curve zone
  - should move 1 – 2mm on blink
- Evaluate after 30 min using the topographer
- Does the Px show a central flattening/steepening effect?

The GOV System
The GOV® System

- Advanced inventory system
- Multi-curve Aspheric Conformed Reverse Geometry Lenses (MAC-RGL)
- Practitioner in control of the lens fit – not laboratories
- Simplified method for myopic & hyperopic correction
- Correct from +5.00D to -10.00D

GOAL

A simple fitting method to start Orthokeratology which allows for growth into fitting higher and unusual powers with the confidence that there is an active support group.

Reverse Geometry Design

- Alignment Zone

GOV® Global patents

<table>
<thead>
<tr>
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GOV™ – Global Orthokeratology Vision

- XMJ – Conformed <-5.00D
- XM – Conformed >-5.00 < -10.00 D
- H – Hyperopia
- HP – Hyperopic Presbyopia
- MP – Myopic Presbyopia
- PL – Post Lasik
- Kc - Keratoconus
- Support Websites
  - www.OrthokInstitute.com

Benefits

Simple effective system
- Practitioner chooses the appropriate lens and makes changes
- Immediate dispensing – (full trial set)
- Efficient and effective method to increase turnover
- Quickly develop a specialty Ortho-k practice
- Confidently fit with GOV support

Fitting GOV Lenses
Fitting GOV® lenses
As easy as 1-2-3
• Select K-code
• Determine Power-code
• Determine Lens sizes (OAD)

K-Code

Calculate K-code by Mean K
• Mean-K=(Horizontal K + Vertical K) / 2
• TK and e values are unnecessary
• ‘e’-value has been calculated into lens
• Change in steps of 0.25D
• Choose the closest mean K for K-code using tables
Prescribe Empirically

- Km: 42.87 \times 44.75 \geq 90
  
Kc: 3.50 - 1.50 \times 180

- Determine K-code
  
  - Mean \( K = (42.87 + 44.75) / 2 = 43.81 \)
  
  - K-code = 43.75

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<th>Dk</th>
<th>0.0</th>
<th>0.5</th>
<th>1.0</th>
<th>1.5</th>
<th>2.0</th>
<th>2.5</th>
<th>3.0</th>
<th>3.5</th>
<th>4.0</th>
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<td>Km</td>
<td>42.87</td>
<td>44.75</td>
<td>87.62</td>
<td>87.62</td>
<td>87.62</td>
<td>87.62</td>
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- OAD 10.8 mm: Best fit cornea = 11.2~11.6 mm (OAD = 93-95% of HVID)

- OAD 10.4 mm: Best fit cornea = 10.8~11.4 mm (OAD = 92-94% of HVID)

- OAD 11.2 mm: Best fit cornea = 11.3~11.9 mm (OAD = 95-97% of HVID)

- OAD 11.6 mm: Best fit cornea = 11.7~12.3 mm (OAD = 98-100% of HVID)


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- OAD 11.6 mm: Best fit cornea = 11.7~12.3 mm (OAD = 98-100% of HVID)
K-code using Trial Lenses

- If initial lens 43.75 fit is too tight
  - Fit a looser lens from trial set
  - Subtract 0.50D from K code (flatter K code)
  - Fit lens: XMJ / (43.25) / -4.50 / 10.8 mm
K-code using Trial Lenses

- If initial lens 43.75 fit is too loose
  - Prescribe a **tighter** lens empirically
  - Add 0.50 D to K code (steeper K code)
  - Fit lens: XMJ / (44.25) / -4.50 / 10.4 mm
Calculate Power-code by S.E.

- SE=Spherical error + (K astigmatism / 2)
- Spherical power must NOT be vertexed
- Changes in 0.25D
- Prescribe
  - Empirically
  - Using Trial Lenses & Over refract

Prescribe Empirically

- Km: 42.87 x 44.75 @ 90
  Rx: -3.50 - 1.50 x 180

- Determine Power-code
  - S.E. = -3.50 - [(44.75-42.87) / 2] = -4.44
  - Power-code = -4.50

Power using Over Refraction

- Select first trial lens by empirical calculation
  - Fit trial set lens
  - Example: XMJ/(43.75)/-3.00,
- Over refraction of XMJ/(43.75)/-3.00 = -1.50D
  - Power-code = -3.00 + (-1.50) = -4.50
- Order XMJ lens as:
  - XMJ / (43.75) / -4.50 / 10.4 mm (Predetermined OAD)
Power Changes

- Moving Left = Less myopia reduction

Lens Diameter (OAD)

Predetermined OAD (lens size)

- OADs of trial lenses are predetermined
- Flatter K's usually measured with larger corneas
- Steeper K's usually measured with smaller corneas

<table>
<thead>
<tr>
<th>KM range</th>
<th>OAD</th>
<th>% of HVID</th>
<th>Best-fit HVID</th>
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<tr>
<td>40.00 ~ 42.25</td>
<td>11.2 mm</td>
<td>96%</td>
<td>11.3~11.9 mm</td>
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<tr>
<td>42.50 ~ 43.75</td>
<td>10.8 mm</td>
<td>94%</td>
<td>11.2~11.6 mm</td>
</tr>
<tr>
<td>44.00 ~ 47.50</td>
<td>10.4 mm</td>
<td>93%</td>
<td>10.8~11.4 mm</td>
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</table>
Verification of corneal size

- Determine corneal size (HVID) by using
  - Graticule in Topographer or Slit-lamp
  - GOV® HVID ruler
- Lens diameter must be 93% ~ 97% of HVID
- If lens diameter is too small
  - Insufficient peripheral stabilization force
- If lens diameter is too large
  - Insufficient central compression & the lens tents up

Determine HVID from Topographer

GOV™ HVID Ruler
Verify K-code

Loose 1.00D
Tight 0.50D
Optimal

Verify OAD

86% (too small)
89% (too small)
95% (Optimal)
98% (slightly smaller)
105% (very large)

Verify Lens sizes (Correct K-code)

Proper (10.8)
0.4 mm Larger
0.8 mm Smaller
0.4 mm Larger
Tear flooding

When the eyes tear excessively the lens will float on the tear layer & simulate a fit that appears too steep or too loose. Pulling the inferior lid off & keeping the lens edge from touching tear meniscus, the Fluorescein pattern becomes a proper bull’s eye fit.

GOV Calculator

Fitting GOV Lenses
- Initial lens is chosen from empirical data
- Fit with diagnostic trial lenses and evaluate NaFL pattern
  - Look for Bull’s eye pattern
- Initial lens should not be too flat or steep
- Should move 1 – 2mm on blink
- Evaluate after 30 min using the topographer
- Does the Px show a central flattening effect?
Fitting GOV Lenses

Flourescein patterns:

Check List for good fit

Lens adaptation and follow-up
• Centration is critical.
• Movement: 1 – 2 mm with blinking.
• Flourescein pattern: Bulls eye pattern.
• Adequate corneal coverage

Fitting GOV Lenses

• If diagnostic lens acceptable allow Px to wear overnight and evaluate the next morning
• Allow a week for fit to settle
• If the lens is too tight or loose after a few days, use a flatter or steeper alignment curve
GOV® Myopic System

Four curve RG lens structure

- **Base Curve**
  - Hydraulic massage on central cornea
- **Fitting Curve (1st reverse zone)**
  - Space for tear circulation and epithelial tissue molding
- **Alignment Curve**
  - Peripheral force to aid molding process
  - Provides centration
- **Peripheral Curve**
  - Tear reservoir

Dual force for cornea molding
GOV® XMJ Lens

- Five or more curve design
- Unique XM curves to help with molding
- Aspheric alignment zone
  - Enhanced peripheral force
  - Better centration and stabilization of lens on eye
- Effective up to –5.00D
  - Molds faster
  - Maintains longer

GOV® High Myopic System

GOV® XM Lens

- Five or more curve design
- Unique XM curves to help molding
- Aspheric alignment zone
  - Enhanced peripheral force
  - Better centration and stabilization
- Effective up to –10.00D (or higher)
- Two step procedure may be required
Mechanism of XM molding

- Optical zone for central compression
- XM curves to enhance peripheral force
  - Maximize H division force
  - Minimize V division force
- X.M. curves to execute template effect
  - Steepen the mid-peripheral cornea

How does Xcessive OK work?

- Compressed Epithelium depth
- Normal edge profile
- Conformed edge profile
How does Xcessive OK work?

What does the XM® curves do?
What does the XM® curves do?

- Conventional Reverse Geometry Design
- Xtreme (XM) Reverse Geometry Design
- Conventional Reverse Geometry Design

Comparing Reverse Curves

-4.00D  -8.00D
Two step procedure might be required for high myopia

• Signs for replacing with 2nd lens
  – Residual myopia (after 2~3 weeks)
  – Unresolved central island
  – Solid midperipheral steeper ring in Topo
  – Tightened lens with central tenting in FP

• Tips for adjustment
  – Usually 1~2 steps looser
  – Looser AC will restore NaFl to Bull’s eye pattern
Hal Ostrom, OD FOAA

- Clinton, CT

Some selected cases with GOV lenses

The GOV XMJ

- 8 yo af
- 2/28/11
  - OD -2.25-.50 x 180
  - OS -2.00 -.5 x 180
- 8/19/09
  - OD -1.00 -.5 x 180
  - OS -1.25 -.5 x 180
Step 1
• K Readings

Step 2
• Determine HVID

Step 3
• Enter Data into the Calculator
• Trial Fit From Calculator

Order Lenses
• XMJ / 43.25 / -3.25 / 10.2 / Green

Overnight PE
20/20
Day 10 PE

- OD
  - VA: 20/20
  - +0.75
- OS
  - VA: 20/20
  - +0.75
- OU
  - VA: 20/15
Day 10 PE

What do you need?
- Good Topographies
- Diameter is Key
- Trial Set

Thank You!
Dual Geometry Lens

Ways to steepen central cornea

- Posterior Aspheric design
- Posterior Aspheric with
  - Reverse zone (RG-DG)
- Posterior Aspheric with
  - Plateau and
  - Reverse zones (DG)

Corneal distortion or reshaping?

Unwanted warpage? Central island? Edema? (Cornea distortion)

Intentional steepening How is it different? (Cornea Reshaping)
Dual Geometry (DG) Designs

- **H lens** (+1.00 ~ +6.00)
  - Aspheric BOZR & Alignment zone
- **HP lens** (PI ~ +6.00 & Add ~+3.0)
  - Aspheric BOZR & Alignment zone
  - Incorporating front progressive Add +3.0
- **MP lens** (-0.25 ~ -10.00 & Add ~+3.0)
  - Aspheric BOZR & Alignment zone
  - Incorporating front progressive Add +3.0

Geometric features of DG lenses

- **Steep-flat-steep-flat** central to Periphery
- **Steeper Central zone**
  - Molding steeper center for Far vision (H, HP)
  - Forming a center reading button (MP, HP)
- **A relatively flat (2nd) Plateau zone**
  - Highlighting central steepening (H, HP)
  - Reshaping an annular zone for distance vision (MP)

Dual Geometry Lenses

Can be smoothened up with aspheric curves

Dual Geometric Lens

Dual Geometric Bifocal

H

EP, HP & MP
GOV® Hyperopic System

Hyperopic Orthokeratology

• Effective up to +5.00D
• No tight lens problems
• Simple method using reference table
• Patented design.

How does Hyperopic OK work?
Dual Reverse Geometry Lens

Neg. Central Pressure
Pos. conformation Pressure
Neg. Peripheral Pressure (Relieve Curve)

Dual Geometric Lens

Fluorescein pattern (HP, H, MP with different central vaulting)

Plateau zone compression
Alignment Zone compression
Reverse zone
Central steepening
Edge Lift
Plateau zone
(for H lenses precision control)

• Hyperopia (H) molding
  – For highlighting central steepening
  – Forming wide & well defined steeper central zone
  – Molding much faster & predictable
  – Less squeezing on central cornea

• How different?

Aspheric OZ without plateau zone  DG lens with plateau zone

14 Days Hyperopia Correction

Case Study

• Male, 27 years
• Building Industry
• RX
  – R: +5.25/-1.50 x 180  VA: 6/36
  – L: +5.50  VA: 6/6
• Post OK
  – R: +0.50  VA: 6/36
  – L: +0.75/-0.25 x 125  VA: 6/6
Post 5 Month – Left eye

2D Tangential Map

3D Tangential Map

DG lens for Hyperopia (ET)

+3.00

+2.75

-0.50D

-0.50D

DUAL REVERSE GEOMETRY LENSES

GOV® Presbyopic System
Presbyopia Options

- Monovision
  - Over plus / Under minus for non-sighing eye
- Central for near Simultaneous Multifocal
  - Hyperopic or lower myopic presbyopia
- Central for far Simultaneous Multifocal
  - Higher myopic presbyopia
- Modified Monovision (Cross Vision)

Precision Control (for Multifocal reshaping)

- Forming Near zone precisely
  - Locus, zone width, steepness
- Smooth transition from near to far
- Reshaping Far zone for
  - Non compromised, functional far vision
- Meeting requirement for whole day clear vision

Presbyopic (HP) Lens

- Sph: Pl to +4.00D
- Add<+2.00
- Fitting
  - Same as for Hyperopic Lens
- Effect takes longer than Myopic OK
  - ±1 month to establish good near VA
How does Presbyopic OK work?

Aspheric Design

- Plateau zone (for EP & HP lenses precision control)
  - Hyperopic Presbyopia (HP) molding
    - Precise reshaping to form a well-defined Para-central Far zone
    - Further steepening to get a sharp central Near zone
Reshaping myopic presbyopia

-7.00 ADD +2.00
20/25 for far, J3 for near

Plateau zone
(for MP lenses precision control)

- Reshaping the Far zone
  - Inward molding by (3rd & 4th) outer zones
  - Flattening far zone by (2nd) Plateau zone
  - Form a wide ablation base to reduce myopia
- Flattening the far zone radially outward
  - Moving more tissue inward than outward
  - Highlight flattening by the steep rim

Further Precision Control
(Centration)

- Lens size
  - Intra limbal, 93-100% HVID coverage
- Sagittal depth conformation
  - Bear lenses for para-central compression
- Aspheric alignment zone
  - Center better with less cornea pinch
Presbyopic Case Study

- Male, 52 years
- Existing Soft Lens Multi-Focal wearer
- Rx
  - R: +1.00/-0.25x75  Add:+2.25
  - L: +1.00/-0.25x130  Add:+2.25

Presbyopic (HP) Lens
Presbyopic (HP) Lens

Dist VA 6/6-2  Near VA: N6

GOV Presbyopic Lens

Far : 20/25 (Before)
Near : J11

Initial
6 hrs

Far : 20/25 (After)
Near : J3-J5

1 hr
2 hrs

Case 1
Low Hyperopic Presbyopia

- 47 y/o female Nurse
- Refraction:
  OD +0.75
  OS +0.25 with add +2.00 (40cm)
- Need better near vision for nursing care
  May accept slightly blurring for far vision
Case 2
Higher Hyperopic Presbyopia

- 45 y/o female, school teacher
- Refraction:
  OD  +4.00 – 1.00 x 15
  OS  +3.75 – 0.75 x 175
  with add +1.50 (40cm)
- Need better far vision for driving but want spectacle free for near work also

Case 2 specs

- KM: OD 43.00 / 44.80
  OS 43.00 / 44.80
  HVID 11mm
- Rx: HP lens with add +2.00
  OD: K(43.75)/P(+3.25)/10.2 mm
  OS: K(43.75)/P(+3.00)/10.2 mm
- Result after 2 weeks till now for 6 months
 Ref:
  OD 20/25, pl - 0.50 x 0
  OS 20/25, pl – 0.50 x 0
  Near: J2 for both eyes
  Wearing lenses for every day

Case 3
Low Myopic Presbyopia

- 45 y/o female
- Refraction:
  OD  -3.00 – 0.25 x 0
  OS  -1.50 – 0.50 x 15
  with add +1.50 (40cm)
- Need better far vision for driving but want spectacle free for near work also
Case 3

- KM: OD 41.75 / 42.50
  OS 41.40 / 42.50
  HVID 11.4 mm
- Rx: MP lens with add +2.00
  OD: K(42.00)/P(-3.50)/11.4 mm
  OS: K(42.00)/P(-2.00)/11.4 mm
- Result after 2 weeks till now for 6 months
  Ref:
  OD 20/20 pl
  OS 20/20 pl
  Near: J3 for both eyes
- Wearing lenses for every day.

Case 4

High Myopic Presbyopia (Modified monovision)

- Ref:
  OD: -8.00 - 0.50 x 90
  OS: -6.25 – 0.50 x 120
  HVID 11.2, add +2.00
  Dominant eye: OS
- Central-far, peripheral - near MP lenses with – 1.00 less in targeted power for OD, full targeted for OS,
- OD 20/40 far, J5 near
- OS 20/20 far, J7 near

Troubleshooting
Alined Fit

Good compression

Trouble Shooting

Ideal fit

Bull’s Eye Pattern
Steep Fit

No Compression

Flatten alignment curve

• Up the column

Steep Fit

4 Steps
Steep Fit
Steep fit – 6 Steps

Trouble Shooting
Central Islands

Steep Fit
No Compression
Central Island

Small areas of distortion along or near the visual axis

Central Island

Cause:
• Alignment curve too tight
• Excessive uncorrected astigmatism resulting in unequal forces on the cornea

Solution:
• Decrease sagittal depth of lens by flattening alignment curve
  – move up the column
• Decentered lens must be centered
• Flatten the BC if caused by uncorrected astigmatism
  – move one column right.

Flat Fit
Steepen alignment curve

• Down the column

Trouble Shooting

Flat Fit – 4 Steps

Trouble Shooting

Smiley Face
Flat Fit Decentred

- Good compression
- Poor seal off and compression
- Good seal off
- Poor Seal Off

Flat Fit

Smiley Face
Flat fitting lens decentered superiorly

Cause:
- Alignment curve too loose

Solution:
- Increase sagittal depth of lens by steepening alignment curve
  - move down the column
Lens Size

Estimate lens size

- Obtain Grey to Grey HVID by Topography
- Verify HVID manually
- Compare HVID to Best-fit HVID of the K-code
- If HVID too large (larger cornea, smaller lens)
  - Loose fit, Decentration, Poor effect
- If HVID too small (smaller cornea, larger lens)
  - Tight fit, Lens Bridging, Central island

Standard lens sizes

- Default OAD based on KM
- KM ranges
  40.00 ~ 42.25 → 11.2 mm
  42.50 ~ 43.75 → 10.8 mm
  44.00 ~ 47.50 → 10.4 mm
Big Corneas

Rule of thumb:
- KM \(\leq\) (flatter) 42.25D
  - 95% to 97% coverage of HVID
- KM between 42.50 – 43.75D
  - 93% to 95% coverage of HVID
- KM \(\geq\) (steeper) 44.00D
  - 92% to 94% coverage of HVID
- 93% - 95% coverage of HVID would suit most corneas most of the time.

Big Corneas

- Use existing trial lenses to evaluate alignment curves
- Determine lens Diameter (OAD)
  - 93% of HVID if KM \(\geq\) 44.00
  - 94% of HVID if KM 42.50-43.75
  - 96% of HVID if KM \(\leq\) 42.25
- It is NOT necessary to alter K-code (alignment) when adjusting for OAD
- In high minus lenses (±40% of cases) a flatter alignment lens will be needed later on

Example:
- 45.25D Lens best fit. HVID: 12mm
  - 93% HVID coverage = 11.2mm
  - 94% HVID coverage = 11.4mm
  - 96% HVID coverage = 11.6mm
  - 45.25D lens (KM steeper than 44.00D) = 11.2mm
Big Corneas

Example how to order:
- 45.25 Lens best fit. HVID: 12mm
  - 45.25 lens (KM steeper than 44.00D) = 11.2mm
  - Eg. XMJ/45.25/-3.00/11.2mm

Big Cornea – Pre fit

Big Cornea

- Male, Age 21
- RIGHT
  - KM= 41.72 = H (41.75)
  - SE= -1.50D = 01 (-1.50)
  - XMJ/41.75/-1.50/10.4mm
- LEFT
  - KM= 41.56 = G (41.50)
  - SE= -1.50D = 01 (-1.50)
  - XMJ/41.50/-1.50/10.4mm
Big Cornea – Post Fit (10.4mm)

Big Cornea (Small lens)

Big Cornea

- HVID = 12.9
- KM > 42.25D
- Rule
  - 95% HVID
  - 95% of 12.9 = 12.25mm
- Final lens ordered:
  - R: XMJ/41.75/-1.50/12.20mm
  - L: XMJ/41.50/-1.50/12.20mm