Virtual Electronic Trouble Shooting
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Disclosure
• Full Time Consultant with ABB Optical Group
• Some slides provided by Patrick Caroline, Randy Kojima, and Craig Norman
• NAO is sponsoring this presentation

Background Information
What Designs are available for fitting irregular corneas?

HIGH DK LENS MATERIALS
• New materials have a DK of well over 100
• PMMA = 0
• Higher oxygen transmission has allowed for larger diameters to be fit without corneal compromise
• GP lenses can now be manufactured in greater than a 20 mm diameter

Disadvantages of High DK Lenses
• High silicone content makes lens surface wetting more of a challenge
• Softer materials scratch easier
• Softer materials warp easier
• Softer materials wear out sooner
• Less deposit resistant
• PROPER CARE SYSTEMS!!!!

Normal Corneas Standard Corneal GP Lenses..Simple
Correcting Corneal Aberrations

- CONTACT LENSES TODAY December 2, 2007

Abstract: GP Contact Lenses and Severe Higher-Order Aberrations in Postsurgical Corneas

Even in the absence of significant residual refractive error, patients can be highly symptomatic after corneal refractive surgery. The presence of glare, halos, monocular polyopia, and loss of contrast are principally caused by the presence of higher-order aberrations. In this study, private practitioners in Texas investigated the efficacy of rigid gas-permeable contact lenses in reducing these higher-order aberrations.

In a prospective study, 20 eyes of 10 consecutive, highly symptomatic patients who had undergone refractive surgery were fitted with semiscleral rigid gas-permeable lenses (Macrolenses). The most successful lens design for each patient was evaluated by using ray-tracing aberrometry (iTrace).

The results showed the cohort had a mean uncorrected visual acuity of 20/30 and a mean best spectacle-corrected visual acuity of 20/25. The mean visual acuity with the treatment lenses was 20/20. The contact lenses reduced the combined higher-order aberrations by a mean of 65% (range, 30%-77%), combined coma by 71% (range, 39%-93%), spherical aberration by 82% (range, 41%-100%), and trefoil by 44% (range, 90% reduction to 727% increase). Multiple linear regression showed a high correlation with preoperative levels of myopia and mesopic pupil area as independent variables and postoperative spherical aberration as the dependent variable (R = 0.82, SE = 0.09, F = 31.08, P<0.0001).

The authors concluded that rigid gas-permeable contact lenses were shown to reduce elevated total higher-order aberrations to normal levels in all of these cases following corneal refractive surgery. The mean reduction was 66% for total higher-order aberrations and 83% for spherical aberration. Correlation was shown between high preoperative refractive error and pupil size in relation to postoperative spherical aberration.


If the Corneal Surface is the Cause Then Tears Correct It (If)
The Lens is centered and not tilted

Centration Over Optical Axis With No “Z” Axis Tilt

- A lens that is tipped or tilted on the cornea can induce significant amounts of unwanted cylinder
- A tilted lens can cause distorted and fluctuating vision
- The steeper secondary curve can help prevent lens tilt as it helps center the lens horizontally, vertically, and without unwanted tilt (adjustable hat band)

Missing Information Using K’s Only

Center Circle = K Reading

Spherical GP Lenses

- Can only impact astigmatism found on the corneal surface
- Can only impact irregularities found on the corneal surface
- Can induce significant astigmatism and aberrations when tilted on the cornea

Designing From Topography

Each Would Need A Different Design
Photokeratoscopy
With No GP

Photokeratoscopy
With GP

Semi-Scleral Lenses
& Scleral Lenses
13.0 mm to 25.0 MM
Large Diameter GP Lens

Vault The Entire Cornea

Each Could Be Fit In A Scleral GP Lens Design

Vault the Difficulty Totally! Without 3-D Mapping, Fitting Set is a MUST!

3-D Mapping

visionary_sMap3D_flyer.pdf

Scleral Landing
Ideal Scleral Landing

Nasal  Temporal

Gaze In All Directions

Evaluating the Edge

Conjunctival Blanching

Looking for the ideal fit

Thickness: 0.30mm/300um
May Need Toric PC’s

Can Order Toric Front Surface Powers With Toric PC’s

Need To Record, Report, Take Photo of, where dots orient

May Need a 14.5 Diameter
- Small Cornea
- Small Fissures
- Ptosis
- Handling Issues

Giant Lens Might Need A Notch

Trouble Shooting
- Bubble management
- ALMOST ALL BUBBLES ARE FROM LACK OF PROPER INSERTION!
SCLERAL LENSES

• Another tool in the toolbox
• Fitting Set a must
• More follow up visits needed
• Somewhat of a steep learning curve on the “how to’s” and the “when to’s” and “why's” in making changes

Reasons Why Scleral Lenses Are Not An Option

• Patient Can’t Handle A Scleral Lens
• Cost is too great
• Has worn corneal GP lenses with great success in the past
• Has failed with scleral lens fitting attempts in the past

SOFT LENSES FOR IRREGULAR CORNEAS

Soft Lens For Irregular Corneas

• Many keratoconic patients can greatly benefit from the comfort of a soft lens
  – GP intolerant
  – GP tolerant but limited wear time/compliance
  – Hybrid failures
  – Scleral failures
• While many corrected patients are “able to see”, their quality of life is adversely impacted
• Unfortunately the performance of typical soft lenses for keratoconus is less than stellar

What makes NovaKone work?

1. NovaKone uses lens thickness to neutralize corneal irregularity
2. The unique NovaKone optical design is then employed to correct for normal spherical and astigmatic refractive errors
3. Dual Elliptical Stabilization™ and precision Rx manufacturing ensure a stable precise Rx lens
Fitting Philosophy

Four Step Process – “from the inside out”
1. Determine Base Curve (central)
2. Determine IT Factor (lens thickness)
3. Determine Lens Power
4. Determine Fitting Curve (para-central)

Evaluate fit with Fluoresoft

Fit Evaluation
with high molecular weight fluorescein

One drop of Fluoresoft with a few drops of saline in the bowl of the lens before insertion

LOW DK MATERIALS
• Very thick lens, 0.40 or thicker
• Over-wear could be an issue
• Watch for neovascularization

Soft Lens For Irregular Corneas
Kerasoft Design
Silicone Hydrogel

Ideal Fit In Kerasoft
Sector Management

Fluting at 3:00 o’clock

Try Next Flatter Lens (mark good)

Try Next Steeper In Kit

Cellphone Videos Emailed

Traditional vs. Newer Designs

CORNEAL GP FITTING
Unique GP Design Developed

- Surgical reshaping of the cornea creates need for reverse geometry lenses
- Reverse geometry lenses begin to be used for orthokeratology
- Reverse geometry lenses now used to better fit irregular corneas

Diagnosing Keratoconus

- Irregular Mires (K’s)
- Smaller than normal mires
- Munson’s sign
- Corneal thinning
- Best corrected acuity less than 20/20
- Oblique axis common
- Challenging Corneal Fits

About OZ Size, Corneal GP Fitting & Keratoconus

- Smaller OZ’s often work best (6.0 to 7.0)
- Lens Diameter doesn’t have to dictate OZ size
- An 11.00 or larger lens can have a 6.5 OZ
- A 8.7 mm lens can have a 6.5 OZ
- More chances of things going wrong with Keratoconus fits if the OZ is too large
- Fit or OZ related?—Flare, Glare, Ghosting

Inferiorly Steep Cones

Be Careful Not Irregular Corneas, But High Riding
Reverse Curve Lenses

- 2nd curve steeper than base curve
- 2nd curve is a stabilizing feature (elastic hat-band on a hat)
- Centration is key to fit and vision
- Reduces possibility of unwanted lens tilt … induced astigmatism, or aberration
- Allows for larger diameters to be fit because of better lens positioning
- **Ease of fit**

Inferiorly Steep Cones

- Small Diameter Traditional Design…No Reverse Curve

Large Diameter Lens With Reverse Curve On Same Cornea

- Apex of Cone

Corneal Lens Design MUST CENTER THE LENS!!!!

- Center the lens using a secondary reverse curve…is the hatband on the hat
- Vault centrally
- 2nd curve locks the lens in position
- Flat Enough PC’s for best tear exchange
- Multiple curves work best
- Scleral Lenses are best for centration
Recommended Corneal Lens Design For Cones/PMD

- Standard small diameter...difficult to make center (position)
- Large diameter (10.5 to 12.00) with Large OZ's too many variables...parameter and fit adjustments a nightmare
- Large Diameter lenses with reverse geometry can often be the answer
- Scleral Lenses often a good choice
- Piggyback fitting...or soft IC designs

Reverse Curve Lenses

- Work well on PMD (Pellucid Marginal Degeneration)
- Reverse curve needs to be less width than on Post LASIK and Post RK designs
- Seal off, too steep a fit, and too great a SAG occurs if width of 2nd curve is too great
- Between 10.0 – 11.00 diameter Work Best
- Optical Zone = 6.0 - 7.0 mm

Good Initial Pattern For Reverse Geo. Large Diameter
This is an xCone Fit

Slightly Steep (just inserted)
Initial Impression (looks good)

Slightly Steep (same lens)
After 10 minutes

Good Fit (after 10 hrs of wear)
Centrally Steep Cones

Recommended Designs For Centrally Steep Cones

- Standard small lens designs usually work well
- Large diameter lens designs are usually not necessary
- Reverse geometry can work, with smaller OZ's and smaller diameters

Small Diameter Designs On Centrally Steep Cones

- Central BC is fit closer to steep K
- Small OZ (usually less than 7.0) works best
- Flat PC system because the cornea flattens rapidly
- Best fit has very limited central touch

Send Your Topo Using Your Cell Phone

NaFl Pics Outside Slit Lamp Using Cell Phone
Without Soft (no piggyback)

Recreate The Surface
- Soft Lens becomes the carrier for the GP lens
- Thicker lens needed (high plus power)
- High modulus when possible
- High DK
- Custom made soft lenses might be needed

Without Soft (no piggyback)

Same GP With Soft Lens Behind It

Comfort Without & With Soft Lens

Too Flat Then Toric PC’s Needed
Good Piggyback Fit

Too Steep? Still Picture vs. Video

GP Needs Independent Movement (piggyback fit)

OCT or Ocular Coherence Tomographer
SCLERAL LENS FITTING WITH EMAIL PICTURES

Central SAG

Temporal Gaze
Seal Off

SUPERIOR GAZE

Good Edge Clearance

Unrestricted (superior gaze)

Nasal Gaze

Seal Off Just Beginning

Edge Lift On Scleral Lens
Not Enough Limbal Clearance

Central Vault

WHAT ABOUT PIGGYBACK?? IS IT A DEAD MODALITY??

OD Graft & OS Early Cone
How about Piggyback?

Reverse Curve On Keratoconus
Xcone (OS)

Piggyback On A Graft
Xcone/soft lens

Central Vault

Good Edge Lift

Well Position

Soft Lens Edge
The Old Piggyback Method Becomes New Again

- High DK materials (140 DK)
- High Modulus Materials (great carrier lens)
- Custom Soft Lenses for extreme challenges
- Center thickness needs to be increased (high plus powers or custom lenses)
- The less the soft lens conforms to the corneal shape the better
- Protection from harm (bandage effect)

What Soft Lens To Select?

- High DK….silicone hydrogel
- High Modulus…..stiffer
- High Plus Power…..thicker (+5.00)
- Custom Made…..if fluting occurs, can control center thickness in a plano power, larger than average diameter, silicone hydrogel material…..quarterly replacement soft lens

Rehabilitating the Cornea

PIGGYBACK FITTING WORKS GREAT FOR THIS!

Piggyback Results in 6 D Cylinder Reduction
Bandage Effect

INTACS For Keratoconus

INTACS TRIAL FITTING
10.5 mm REV. GEO
INTACS GP Fit
11.2 Diameter Rev. Geo.

Without +5.00 Soft Lens

With +5.00 Soft Lens

With & Without +5.00 Soft Lens

How To Fit This Cornea?
79 D Steep!!

Extremely Steep and Irregular Corneas

How this piggyback modality worked wonders
Case History
Topography On Piggyback Fit
84 D Steep

Tried Standard Soft Lens
• No standard soft lens would fit this steep cornea
• Went to custom soft lens for best fit using silicone hydrogel material
• 15.0 mm diameter, 8.3 base curve, 3 steeps steeper than standard on PC’s

>80D Steep Cornea
5.25 BC, -22.00, 10.0 diam.

Which Modality Should We Choose?
• Traditional small lenses (corneal)
• Traditional large diameter lenses (corneal)
• Reverse Geometry (corneal)
• Piggyback Modality
• Irregular Cornea Specialty Soft Lenses
• Scleral Lenses

Hopefully you better understand the use for each of these lens designs!
THANK YOU AND GOOD LUCK WITH THESE CHALLENGING FITS