Troubleshooting
The Orthokeratology Fit

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Course Objectives
• Learn how to recognize and deal with the various challenges that can present during the process of fitting an orthoK lens
  • Less than optimal lens positions
  • Adverse physiological response

Corneal Topography
• Corneal topography, do you really need it?
  • No because you can order and fit lenses empirically with keratometry and refraction
  • Yes because you have absolutely no idea what is happening at the cornea especially if your treatment needs troubleshooting
  • Fluorescein patterns are helpful, but not as precise as topography for treatment management
    • Fluorescein does not fluoresce when less than 20 microns thick. What looks like touch is not necessarily touch.
  • Topography measures over 9 mm of corneal shape as opposed to 3 mm on keratometer
  • OrthoK fitting happens at about the 8 mm chord of the cornea

Disclosures

Paid consultant to: Tianjin Shidajia (MasterVision) Science and Technology Co., Ltd
This presentation is given without commercial bias.
Corneal Topography

• If you think OrthoK can be done without topography
  YOU’RE WRONG!

Is this enough data? This is the central 3 mm the keratometer gives you.

Here’s the rest of the story. Still think you don’t need a topographer?

Starting the Fitting Process

GOOD TOPOGRAPHY

NOT GOOD TOPOGRAPHY

BAD TOPOGRAPHY
Understanding OrthoK
Is it all about flattening the central cornea?

In the previous example,

\[ 42.98D - 37.33D = 5.65D \]

The central cornea flattened by 5.65D

So how did this -7.75D myope achieve 20/20 vision?

Remember, we’re not smashing the central cornea.
We’re flattening and steepening at the same time while providing a soft landing area and healthy edge lift.
Troubleshooting

- Use your brain
- Call a colleague
- Use lab consultants
- Seek inspiration elsewhere

It’s been here the whole time, use it!

Look at your retinoscopy reflex!
Typically indicates a fit that is relatively too flat. The lens decents superiorly with the resulting topography showing a crescent-shaped area of steepening within the pupil zone and the area of apical flattening decentered upwards.

When lens sag is insufficient (RZD too small) will show superior decentration and little or no peripheral touch.

When LZA is too flat, there will be excessive edge lift and the lens will land inwardly toward the return zone. There will be excessive fluorescein at the edge.

Fixing Smiley Face Topography Pattern:
- Increase sagittal depth of lens
- Alignment zone is too flat, therefore steepen
  - Return Zone too shallow, need to increase
- Edge lift is too great, therefore decrease
  - Landing Zone too flat, therefore steepen
- Tight lids can pull a lens up as well
- Could apply base down prism (on some lens designs)
- Increase lens thickness to increase mass and help lens “drop” a bit
- Increase OAD to assist centration
- Watch out for toric periphery. If 90/270 much steeper than 0/180, lens may pull up (or down)
  - Toric peripheral curves may be needed
- Let’s talk Elevation…
Corneal Elevation
Why does a lens decenter?

**Axial**

**Elevation**

**Tangential**

**Result**

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**Troubleshooting**

**Frownery Face Topography Pattern**

 Indicates a fit that is relatively too steep. The lens decenters inferiorly with the resulting topography showing a crescent-shaped area of steepening within the pupil zone and the area of apical flattening centered downwards.

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**Troubleshooting**

**Frowney Face Topography Pattern**

When lens sag is too great (RZD too great) will show little or no TxZ, or large bubble in reverse curve.

When LZA is too steep, there will be insufficient edge lift and the lens will land too far outwardly toward the periphery. There will be insufficient fluorescein at the edge.
Troubleshooting
Fixing Frowney Face Topography Pattern

• Decrease sagittal depth of lens
  • Alignment zone is too steep, therefore flatten
  • Return Zone too deep, need to decrease
• Edge lift is insufficient, therefore increase
• Landing Zone too steep, therefore flatten
• Tight lids can push a lens down as well
  • Decrease lens thickness to decrease mass so lens will not drop as much (watch flexure)
  • Increase OAD to assist centration
• Watch out for toric periphery. If 90/270 much steeper than 0/180, lens may slide down (or up)
  • Toric peripheral curves may be needed

Troubleshooting
Smiley Face vs Frowney Face

• Superiorly/inferiorly decentering lenses can occur when the sagittal depth of the lens does not match the cornea. Steep lenses can decenter up or down as can flat lenses. If both conditions could be caused by a lens being too steep or too flat, how can you tell the difference?

  • Let your fluorescein patterns guide your decision.
    • If you see no identifiable treatment zone, you know the lens is too steep (sagittal depth too great)
    • If edges look like they are flaring, or the treatment zone appears especially dark, you know the lens is too flat (sagittal depth insufficient)
    • Central SPK often indicates a lens that is too flat

Troubleshooting
Central Island

• Indicates a fit that is relatively too steep.
• Refraction will show more myopia than pre-fit level.
  • When a lens is too steep centrally, the cornea may steepen centrally rather than flatten as we would anticipate when performing OrthoK for myopia.

  • Recheck your topography patterns
  • Recheck your keratometric values
  • Was there an error in K reading or SimK readings?
  • Make sure the patient did not switch their lenses
  • Recheck base curve of lenses on Radiuscope if available
Troubleshooting

False Central Island

• Indicates a fit that underestimates the corneal sag.
• The lens sag is significantly less than the corneal sag leading to heavy central baring and epithelial disruption.
• The refraction should not show greater myopia than pre-fit level
  • This is the difference between central islands and false central islands. False islands are caused by SPK.
• May need to reassess fit, condition of lenses, insertion techniques, insertion solutions used
• In the event that lens sag is correct and the SPK was caused by other conditions (ie dirty lens), may need to give lenses more time before making changes

Troubleshooting

Lateral Decentration

Lateral decentration can be the most difficult fitting anomaly to correct. The reason is because there could be several causes of decentration. Critical examination of NaFl pattern should guide the decision making.

Causes of lateral decentration include:
• Insufficient lens diameter
  • Lens should consume 92-97% of HVID (or more!). Inspect VVID (if possible) and DVID as well when deciding on lens diameter
Measuring HVID/DVID

Where is the end of the cornea?
Measure white to white.
Guestimate big.
DVID > HVID

Troubleshooting
Lateral Decentration

• Lens sag insufficient
  • Flat lenses will "rub" the apex of the cornea and cause SPK. This will also cause the lens to move on the eye
• Lens sag excessive
  • If a lens is too steep it may drop and become laterally decentered

Troubleshooting
Lateral Decentration

• Eye lid forces
  • Asian eyes can be a challenge
• Sleeping position
  • Sometimes need to counsel patients on sleeping positions
• Lagophthalmos
  • May need to use hyper viscosity drops or gels
• Erroneous topography data
  • MAKE SURE YOU HAVE GOOD MAPS!!!
• Compare SimKs to Manual Ks
• Just because they want to
  • Sometimes they just decenter no matter what you try. May opt for CorneoScleral design (highly advanced OrthoK)

Troubleshooting
Lateral Decentration

• Deposits on lenses
  • Must stress/insist on compliance with cleaning regimen
• Can use Progent in office
• Hand polishing machine
• Lens cleaning sponge
• Review/change care system
• Consider lens replacement
**Troubleshooting**

**Lens Binding**

- Commonly caused by having patient present with lenses in situ (controversial)
- Patient-specific – sometimes it just happens to certain patients
- May be dependent on tear film viscosity

**Removing a Bound Lens**

- Instill a few drops of artificial tears
- Look upwards and press against the inferior limbus with the edge of the lower lid a few times
- Look downward and repeat the process at the superior limbus
- Once the patient becomes aware of the feeling of lens movement, the lens can be safely removed
- WARN THEM ABOUT THIS BEFOREHAND. THEY WILL BE MUCH LESS FRIGHTENED IF THEY KNOW TO WATCH FOR IT
Troubleshooting

Corneal Staining

- Central staining often from insufficient sag, unclean lenses or solution toxicity
- 3 and 9 o’clock staining
- Lens binding
- Grade 1 or less staining is clinically insignificant and usually resolves within an hour of lens removal
- Grade 2 + staining is unacceptable
- Central staining can cause “fake” central island on topography

Diffuse grade 1 corneal staining is usually caused by heavy build-up of deposits in the back of the lens

Troubleshooting

Corneal Abrasion

- Dirty lens
- Chipped/cracked lens
- Rubbing eyes during lens wear
- Most often handling difficulties, insertion/removal
- Treatment protocol well established
- Depending on severity, may need to postpone OK treatment until resolved

- Check for surface quality defects, scratches, poor wettability, warpage.
- Warpage can be seen by cylindrical over refraction, topography done with lenses on, in lensometer or in radiuscope
Troubleshooting

Dimple Veiling

- Not fluorescein staining, but pooling
- Often caused from bubbles in too steep or too wide RC which break down and froth
- Usually recovers in 1-2 hours
- If fit is good, filling lens with non-preserved sterile saline solution before insertion should help

Epithelial Iron Deposition

- Common
- Typically occurs in the same area as the reverse curve under the lens and coincides with the area of greatest corneal curvature change
- Can be incomplete or complete rings
- Not pathological and requires no treatment
- Easily viewed with blue filter (no NaFl)

Microbial Keratitis

- Obviously the one we never want to see
- Low likelihood with good patient compliance, proper aftercare
- Patients must remove their lenses and seek urgent medical attention
- Only materials approved for overnight use should be used

Microbial Keratitis

“A post market study of Orthokeratology conducted by the FDA and the Ohio State University showed an incidence of microbial keratitis of 7.7 per 10,000 person-years of wear, making Orthokeratology wearers only slightly more susceptible to infection than daily wear soft contact lens wearers at 4.1 per 10,000. This rate is lower than that found with continuous wear of soft contact lenses which range from about 18 to 20 per 10,000.”

From Eiden, S.B. “Infectious Keratitis Associated with Corneal Reshaping: It’s Important to Look at the Details” Contact Lenses Today 09/14/2014
Troubleshooting

Loss of Effect

- Often associated with heavy back surface deposits on the lenses
- Can be caused by lens warpage
- Common if lenses are inadvertently put in the wrong eyes (different color lenses can avoid this complication)

Troubleshooting

Glare/Photophobia

- Often occurs in patients with large pupils
- More common when correcting high myopia as TxZ diameter decreases
- Tends to improve over time
- May use Alphagan “off label” to produce some miosis at night
- May need to increase treatment zone diameter (when appropriate or available)
- Corneo-scleral Ortho-K?
- Aspheric TxZ?

Understanding

Tear Layer Profile Systems

Wave®

Lens design Window.

Good or Bad?
Good or Bad?

What did I do?

Lifted alignment curve which lowered sagittal height. Changed periphery to "free form" for better seal 360 degrees.
Good or Bad?

Good

Good or Bad?

Good
Good or Bad?

Fair (not bad for a -7.00)

What did I do?
Lifted/flattened alignment curve and decreased return zone depth which lowered sagittal height.

Good or Bad?
Clinical Pearls

- Don’t say yes just because your patients do
- Talk talk talk. Engage patient in the process
- Provide sufficient written information
- Make yourself available
- Use caution when delegating too much to staff
- Do your own topos
- Do not squeeze in, give them sufficient time
- Progent lenses every 6 months or more if needed
- Reinforce care at each and every visit
- Always have them bring their lenses to the office
Clinical Pearls

• Don’t make hasty changes. Sometimes the process needs time to work
• Lenses fit differently during sleep than they do at the slit lamp. Rely heavily on your topographies for position
• Need buy-in from staff
• Charge for your time and expertise!
• Ask for referrals and testimonials
• CE!! Travel, take the time, learn all you possibly can
• Under promise and over deliver
• Make them feel special. These are not your average lens wearers. These are your “A” patients