A Smashing Success: Corneal GP Fits in a Keratoconic Patient

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Background

Contact lenses are used for visual rehabilitation in keratoconus and other forms of corneal ectasia. While mild cases of keratoconus can be well corrected with soft contacts that drape over the cornea, moderate to severe keratoconic eyes require rigid materials to achieve acceptable corrected visual acuity. Patients who are established in corneal gas permeable (cGP) lenses can benefit from updates to lens material and design with the goal of enhanced comfort and vision.

Case Details

- **70 Year Old Caucasian Female**
- **CC: Vision isn't as clear as it used to be with habitual cGP lenses**
- **Medical History:** Sleep apnea, hypertension
- **Allergies:** None
- **Medications:** Redness reducing drops every morning
- **Ocular History, both eyes:**
  - Keratoconus
  - Presbyopia
  - Nuclear sclerosis
  - Marginal keratitis
- **Vision**
  - With habitual cGP
    - Right eye 20/50
    - Left eye 20/250
- **Contact lens assessment**
  - Unknown parameters
  - Both eyes: inferior decentration and central bearing
  - Right eye: adequate movement
  - Left eye: fixed on the inferior cone without movement, superior edge bisecting pupil
- **Cornea assessment**
  - Right eye: moderate cone without scarring
  - Left eye: severe cone with Fleischer ring, without scarring

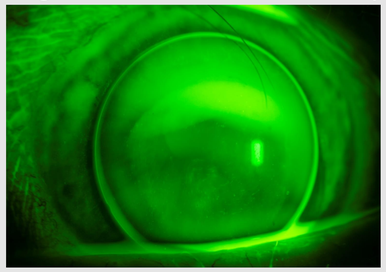
Contact Lens Selection

Rose K2 lenses (Menicon) are designed with aspheric optics and have automatic adjustments made to the lens as the BC or edges are change in order to preserve the sagittal fit. Their Asymmetric Corneal Technology (ACT) design can further optimize fit and comfort in keratoconic eyes. If fitting empirically, the average K taken at a 5mm radius on the axial map is found to be a reliable predictive parameter of base curve.

Demonstration of Rose K's optional ACT, where the inferior edge is "tucked" to go under the edge of a central cone

Clinical Findings

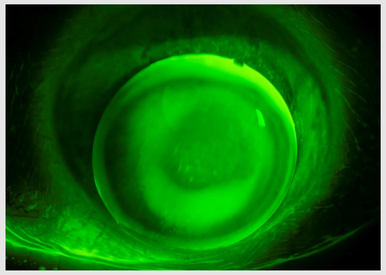
Progression of Lenses on Left Eye



Habitual lens: Decentered inferior, bearing over cone, minimal movement, insufficient edge lift

Goal: decrease bearing, improve centration, improve comfort and vision

Changes: steepened BC, use toric PC, small diameter

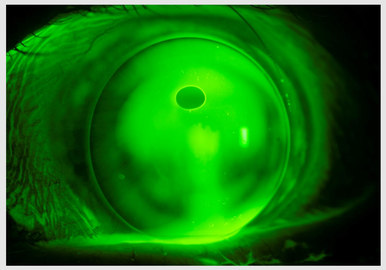


Lens 2: moving with blink, still apical bearing, though lessened

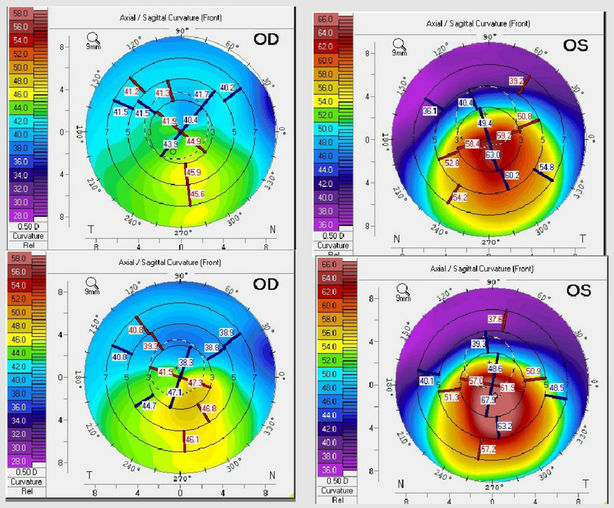
Goal: decrease bearing to 3-point-touch relationship

Change: steepened BC

Lens number	Right Lens BC/Diam	Left Lens BC/Diam
Trial Lens	7.6 / 9.2	6.1 / 8.7
Lens 1	7.52 / 9.2	5.99 / 8.7
Lens 2	7.52 / 9.2 toric PC	5.88 / 8.7 toric PC
Lens 3	-	5.73/9.0 toric PC



Lens 3: too steep, bubble superior with partial cone clearance, close to 3-point-touch



	OD	OS
Baseline KMax	46.1	64.5
Follow Up KMax	48.4	71.0

Tomography and table of both eyes demonstrating the change in corneal shape (axial map) over a 3 month period

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Discussion

Approach to Fitting cGPs on Keratoconic Eyes

- Vision rehabilitation with cGP lenses was found to improve vision, depth perception, and vision-related quality of life, compared to spectacle lens correction.
- cGPs may be fit by three methods: flat, steep, or 3-point-touch
  - **Flat** (apical touch): cGP rests on the apex
  - **Steep** (apical clearance): cGP rests on the midperiphery
  - **3-point touch**: cGP rests partially on both the apex and midperiphery
- cGP lenses have traditionally been fit flat on keratoconic eyes. The reasons cited for this have not held up as true in longitudinal studies, but include:
  - Easier fitting process for the practitioner
  - Better vision for the patient
  - Flattening the cone decreases disease progression and the need for PK

Evidence-Based Fitting

- Fitting guides of cone-specific lenses are designed with the goals of simplicity and minimal chair time in mind.
  - For any cGP lens, FDACL based fitting, as demonstrated by the CLEK study, provides a high first-lens success rate. 83% of 3-point-touch and 71% of apical touch lenses were acceptable final lenses.
  - For the Rose K lens, the 5mm average K on the axial map has been found a reliable parameter in initial base curve selection.
- Two longitudinal studies, CLEK and DUSKS, found that BCVA was not better in flat or steep fitting lenses.
- There is no evidence to support the theory that a flat lens fit delays the progression of keratoconus.
  - Any lens fit can improve BCVA as it corrects for irregular astigmatism. Therefore, the need for PKs based on unacceptable BCVA is lessened.
  - A poor lens fit may contribute to the need for a PK if a scar is formed.
- Comfort must also be considered in cGP fits for KCN. The CLEK study group found that appropriate edge design was the most important factor in lens comfort, and that apical fitting relationship did not impact comfort.
- The CLEK study determined that corneal scarring is associated with disease severity, as determined by Kmax. Apical fitting relationship was not found to affect scar formation of an 8 year period. However, there has never been a clinical trial to evaluate if flat or steep lenses cause, or worsen, apical scarring.

Conclusion

Habitual cGP wearers can be refit into new cGP lenses that are designed with keratoconus in mind to improve comfort, vision, and corneal health. A challenging aspect of these cases is dealing with corneal rebound. Many patients are happy with their vision in an apical touch lens causing cone compression. As steeper cGP lenses are used, the cornea will rebound, causing the fit of the lens to differ from dispense to follow up. During this time, patients may notice fluctuations in vision. This anatomical change necessitates lens adjustments to continue to improve the fit.

References

1. Lim L, Lim EWL. Current perspectives in the management of keratoconus with contact lenses. *Eye (Lond)*. 2020;34(12):2175-2196. doi:10.1038/s41433-020-1065-z
2. Zadnik K, Barr JT, Steger-May K, et al. Comparison of flat and steep rigid contact lens fitting methods in keratoconus. *Optom Vis Sci*. 2005;82(12):1014-1021. doi:10.1097/01.opx.0000192349.11525.de
3. Romero-Jiménez M, Santodomingo-Rubido J, González-Méijome JM. An assessment of the optimal lens fit rate in keratoconus subjects using three-point-touch and apical touch fitting approaches with the rose K2 lens. *Eye Contact Lens*. 2013;39(4):269-272. doi:10.1097/ICL.0b013e318295b4f4
4. Mandathara Sudharman P, Rathi V, Dumapati S. Rose K Lenses for Keratoconus—An Indian Experience. *Eye & Contact Lens* 2010;4: 220222
5. Menicon. Rose K fitting guide. 2013