

## Background

- 33 year old Hispanic Male
- Medical History: Unremarkable
- Ocular History: Diagnosed with Keratoconus around the age of 17, OS>OD  
-Crosslinking performed 2015 on OD and OS
- Medications: None
- Other information: Brother also diagnosed with Keratoconus

## Case Details

Case history:

- Chief Complaint:

Patient presented on 9/11/2017 after being referred for a specialty contact lens fitting. Per patient, he was diagnosed with keratoconus and had cross-linking done in 2015 due to progression. He denies ever wearing contact lenses and states that his vision has stabilized, but not improved, post-crosslinking.

- Visual Acuities(sc):

\*OD: 20/70 PH: 20/30+

\*OS: 20/70- PH: 20/60<sup>-2</sup>

- Pupils: PERRL OU (-)APD

- All other entrance testing was unremarkable.

## Slit Lamp Findings

OD	Slit Lamp Exam	OS
Clean	Adnexa	Clean
Deep and Quiet	Anterior Chamber	Deep and Quiet
Clear	Bulbar/Palpebral Conjunctiva	Clear
Clear	Episclera/Sclera	Clear
Inferior scar ~2mm, minimal thinning, (-) Fleisher ring, Vogt's striae	Cornea	Minimal thinning, (-) Fleisher ring, Vogt's striae, scarring
Brown, flat/intact	Iris	Brown, flat/intact
Clear	Lens	Clear

Table #1: Slit lamp examination findings

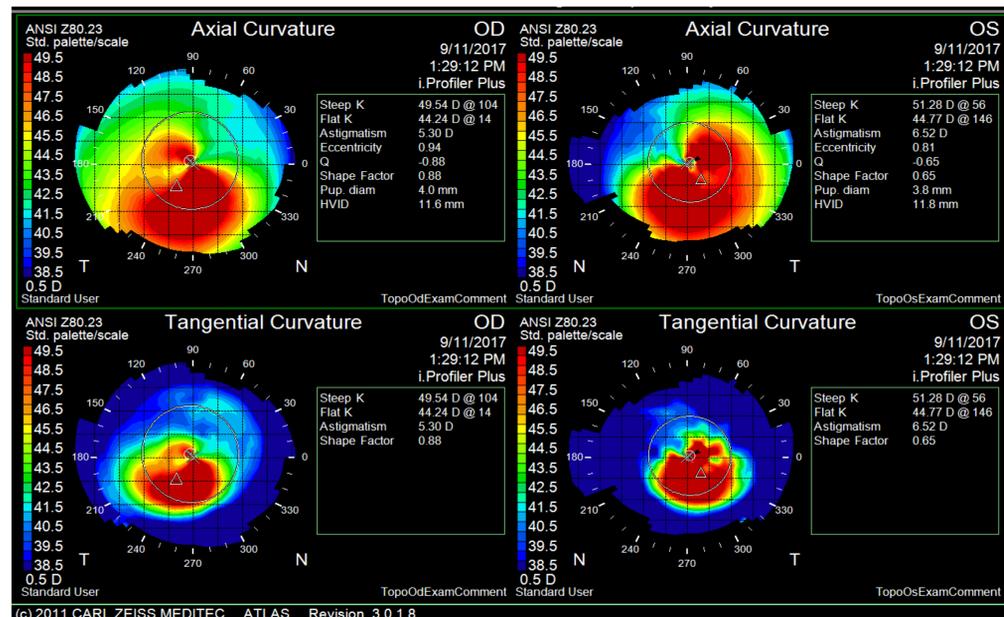


Image #1: Topography Results; OD inferior displaced cone 2.0 mm H x 2.0 mm V; OS inferior displaced cone 3.00 mm H x 3.00 mm V

## Contact Lens Fitting & Assessment

OD	Rose K2 XL (Art Optical)	OS
7.30 mm	BC	7.20 mm
-3.00	Sphere	-4.00
14.6	Diameter	14.6
0.20	Thickness	0.19
Standard	Edge Lift	Standard
-3.00 DS	Over-Refraction	-3.00-0.75x030
20/20-1	Visual Acuity w/ OR	20/25+2
Menicon Z	Material	Menicon Z

OD Assessment: moderate central clearance w/ minimal pupil appreciation, good limbal clearance, minimal edge lift without blanching or impingement 360, good movement, comfort, and vision

OS Assessment: feather touch centrally with good limbal clearance, minimal edge lift without blanching or impingement 360, good movement, comfort, and vision

Table #2: Initial Diagnostic lenses and assessment; the first diagnostic Rose K2 XL lenses were selected using the fitting guide, which suggests selecting the BCR from the mean keratometric readings.

OD	Rose K2 XL (Art Optical)	OS
7.30 mm	BC	7.20 mm
-6.00 DS	Power	-7.00-0.75x030
14.6	Diameter	14.6
0.20	Thickness	0.19
Standard Flat Lift	Edge Lift	Standard Flat Lift
20/20	Visual Acuity	20/25+1
Menicon Z	Material	Menicon Z

OD Assessment: moderate central clearance w/ minimal pupil appreciation, good limbal clearance, improved edge lift without blanching or impingement 360, good movement, comfort, and vision

OS Assessment: feather touch centrally with good limbal clearance, improved edge lift without blanching or impingement, good movement, comfort, and vision

Table #3: Final Lenses w/ parameters and assessment

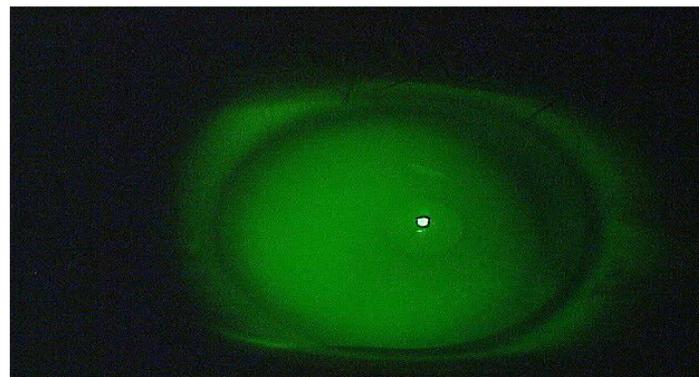


Image #2: Final Rose K2 XL Lens OD



Image #3: Final Rose K2 XL Lens OS

## Discussion

Before the FDA approval of cross-linking, many patients with unstable, progressive keratoconus had to resort to invasive and risky surgical procedures such as a perforating keratoplasty. Complications that can arise are rejection, transplant failure, secondary cataract, glaucoma, or recurrence of keratoconus in the transplanted cornea. Other conservative procedures such as intracorneal rings and lamellar keratoplasty can temporarily help the refractive effect but do not stop the progression of keratoconus. Cross-linking has not only shown to be effective against the progression of keratoconus but has also demonstrated to provide an average visual improvement of 1-2 lines with best correction. Due to the improved integrity of the cornea post-crosslinking, clinicians should strive to use lenses that provide minimal to moderate vaulting and thinner lenses that can provide optimal oxygen permeability, such as semi-scleral lenses.

A study performed by L. Michaud et al. concluded that scleral lenses with the highest DK material designed with a maximum central thickness of 250 um that is fitted with a clearance no higher than 200 um will provide optimal conditions to avoid corneal swelling.

	Clearance	100 μm	125 μm	150 μm	200 μm	250 μm	300 μm	350 μm	400 μm	
Lens Dk										
100		291	260	229	167	104	42	-20	-80	Negative thickness indicates impossibility to manufacture such a lens
125		364	325	286	208	130	52	-25	-100	Possible to manufacture-but lens likely to flex/break due to reduced thickness
150		437	391	343	250	156	62	-30	-120	
170		495	443	389	283	177	70	-35	-136	
200		583	521	458	333	208	83	-40	-160	
250		729	651	575	417	260	104	-50	-200	Optimal lens to manufacture
300		875	781	687	500	312	125	-60	-240	

Figure #1: Predicted maximum central lens thickness (um) to prevent hypoxia-induced corneal swelling in daily-scleral lens wear considering determined clearance values

## Treatment and Management

Due to the location and size of cone in an otherwise healthy cornea, a semi-scleral lens, rather than a larger scleral lens, was predicted to stabilize adequately on this patient and provide good vision while optimizing oxygen availability to the cornea. Both Rose K2 XL lenses dispensed to the patient met the H/M Dk/t criterion of 24 Dk/t units centrally that prevent hypoxia-induced corneal swelling. The following formula developed by Michaud et al. was used to calculate Dk/t values:

$$\frac{Dk}{t_{scl}} = \frac{1}{(t_1/Dk_1) + (t_2/Dk_2)}$$

With a Dk/t value of 40.48 and 41.41 for the right and left eye, respectively, the patient is scheduled to return to clinic in 6 months to monitor health, vision, and fit of the lenses.

## Conclusion

-Cross-linking allows corneas to regain rigidity and stability, allowing practitioners to fit patients with a variety of specialty lenses instead of sending them for a perforating keratoplasty.

-Fitting a lens with a maximum of 250 um central thickness, 200 um of clearance and maximum DK value will provide optimal conditions to avoid corneal swelling, as concluded by Michaud et al.

-Semi-scleral lenses provide optimal vision and comfort without having to excessively vault the cornea and prevent the risk of corneal swelling.

## References

1. Raiskup-Wolf, F. et al. *Collagen crosslinking with riboflavin and ultraviolet-A light in keratoconus: Long-term results.* Journal of Cataract and Refractive Surgery. May 2008. Vol. 34. 796-801.
2. Kluwer, W. *The Wills Eye Manual.* Seventh Edition
3. Michaud, L. et al. *Predicting estimates of oxygen transmissibility of scleral lenses.* Contact Lens & Anterior Eye 35 (2012) 266-271