Fitting Scleral Lenses after Corneal Allogenic Intrastromal Ring Segments (CAIRS)

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Background

Corneal allogenic intrastromal ring segments (CAIRS) is a method by which allogenic tissue is implanted into the peripheral stroma for a keratoconic cornea in the form of a ring segment to help recenter and flatten a cone. While similar to intrastromal corneal ring segments (ICRS), CAIRS has been shown to not have the same complications associated with synthetic intracorneal ring segments, while improving corneal topography and visual acuity. Because of the novelty of this procedure, there is minimal literature regarding the management of post-CAIRS patients with specialty contact lenses. The following is a case series of scleral lens fits who have undergone the CAIRS procedure.

CAIRS Surgery

- Zeiss VisuMax Femtosecond Laser creates a deep, U-shaped tunnel, allowing for an allogenic tissue segment to be inserted into the tunnel

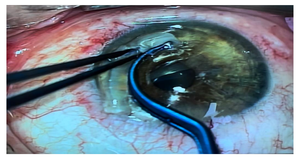
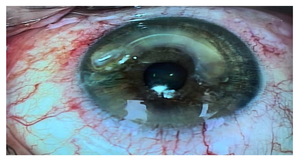



Fig 1-2. Intraoperative photos demonstrating the CAIRS procedure, and the insertion of the donor allogenic corneal stromal tissue into the U-shaped tunnel

Case #1

Demographics	54-year-old Asian Indian male
Chief Complaint	KCN evaluation – states vision is getting “worse”, and goal is to make prescription “more simplified”
POHx	KCN OU (1980) – stable for 10 years per previous provider Used glasses, corneal RGPs and scleral lenses Cataracts OU, ERM OU
Visual Acuities	Uncorrected: OD: 20/300 With Scleral Lenses: OD: 20/30
Refraction	OD: -10.25 -4.50 x 030 VA: 20/60
Slit Lamp Exam	Central cone with inferior thinning OU 2+ NSC OU

- Recommended CAIRS OD

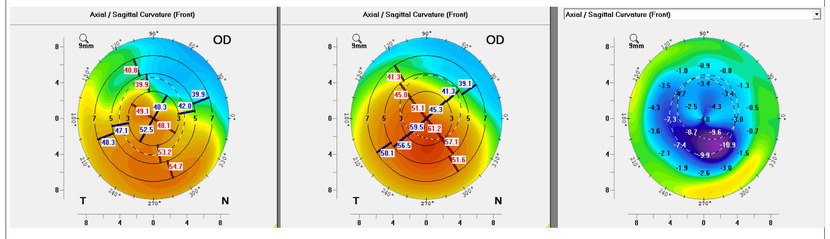
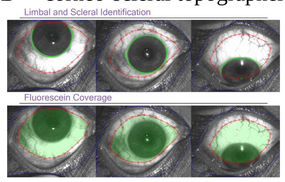


Fig 3. First image (left) shows the patient’s corneal topography post-CAIRS procedure, while the second image (middle) reveals the patient’s corneal topography at the initial consultation. The third topography (right) is a difference in topographic values between the two images, and reveals a significant amount of flattening infero-centrally.

- The patient indicated improvement in uncorrected visual acuity (UCVA: 20/80-1) even 1 day after surgery, however noticed vision started to worsen due to worsening nuclear sclerotic cataracts
- Patient pursued cataract surgery 5 months post-CAIRS OD
- 1 week s/p cataract surgery, patient was seeing 20/70+2 uncorrected
  - Refracted to 20/30+2 with +0.50 -5.00 x 025

Scleral Lens Fitting

- 5 weeks post-cataract surgery, patient was then fit into a -3.50 -0.62 x 175, 17.00 mm free-form Visionary Optics Latitude scleral contact lens utilizing the sMap3D™ corneo-scleral topographer



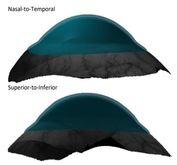


Fig 4 and 5. The image on the left shows how points were mapped utilizing sodium fluorescein while the patient was in up-gaze, primary gaze and down-gaze. These images are then “stitched” together to create a complete ocular surface profile for the Latitude lens.

- Corrected VA with scleral lens was 20/20
- The patient reported all day comfort with the lenses and was able to decrease scleral lens wear time to 12 hours from 20 hours a day because of improved UCVA

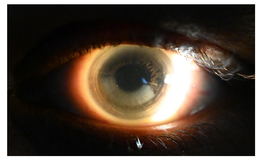
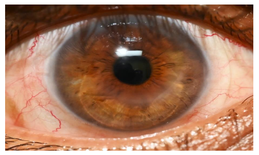



Fig 5 and 6. The left image shows the shows the allogenic ring segment underneath the scleral lens through sclerotic scatter. The right image shows the free-form scleral contact lens that the patient was fit into after cataract surgery.

Case #2

Demographics	28-year-old Caucasian male
Chief Complaint	Poor vision- lost the ability to read. Subsequently, the patient was unable to successfully complete his education.
POHx	KCN OU, epi-off CXL OU in 2020 Used glasses, failed corneal RGPs and scleral lenses
Visual Acuities	Uncorrected: OD: 20/125, OS: 20/200
Refraction	OD: -3.25 -4.75 x 080 VA: 20/50 OS: -5.50 -1.50 x 140 VA: 20/60
Slit Lamp Exam	Unremarkable other than mild corneal haze OU

- Discussed surgical options, patient elected to proceed with CAIRS OD and toric ICL OS

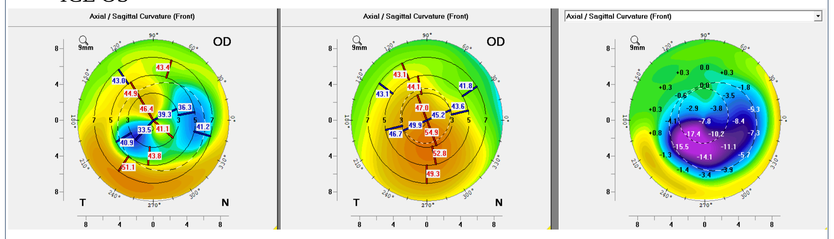


Fig 7. The left image shows the patient’s OD corneal topography post-CAIRS, middle topography shows the initial topography, and the right image illustrates the difference between the two. Again, note the significant infero-central corneal flattening post-CAIRS.

- 1-month post-CAIRS OD and toric ICL OS, the patient’s UCVA was 20/125 OD and 20/50 OS
  - Refraction OD: -0.75 -4.00 x 100 BCVA: 20/50+
    OS: +0.75 -1.75 x 152 BCVA: 20/40+1
- Patient however stated OS still had more blur and ghosting compared to OD
  - Recommended CAIRS OS

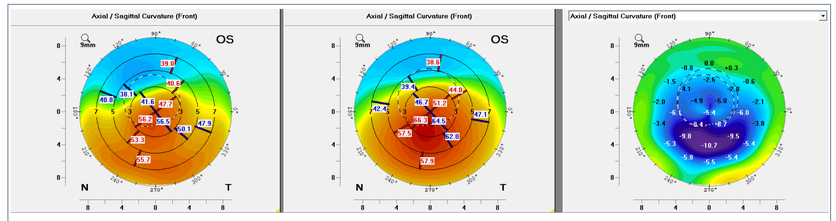


Fig 8. Left image shows the patient’s OS corneal topography post-CAIRS, middle topography shows patient’s initial topography, and the right image illustrates the difference between the two. Again, note the significant infero-central corneal flattening post-CAIRS.

Scleral Lens Fitting

- 1.5 months post CAIRS OD, patient was fit into a -2.62 DS, 16.0mm Alden Optical Zenlens Prolate scleral lens
  - Manifest Refraction:+1.00 -4.25 x 100, VA: 20/40
  - Corrected VA with the scleral lens was 20/20
  - Stated the vision even in the first trial lens was the best it has been in 3 years
- 1.5 months post CAIRS OS, patient was fit into a -0.67 -1.75 x 085, 16.5mm free-form Visionary Optics Latitude scleral lens
  - Manifest Refraction: +1.50 -1.00 x 135, VA: 20/25+
  - Corrected VA with scleral lens was 20/30
  - Patient was moving to another state so a free-form lens was utilized to achieve a closer endpoint with the first received lens
- Patient stated that there was significant improvement in distortions when uncorrected, through manifest refraction and through scleral lens

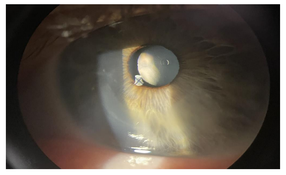


Fig 10. Slit lamp photo of the EVO Toric ICL and CAIRS ring segment implanted in the patient’s left eye

Discussion

- Introduced by Dr. Soosan Jacob in 2018, CAIRS is a method to flatten the keratoconic cornea
- These two cases highlight the improvement in subjective vision and reduction in distortions, blur and ghosting
- Both patient achieved significant amounts of corneal flattening with CAIRS
- Two out of the three eyes achieved their most optimal vision through a scleral contact lens
- CAIRS has also allowed for less dependency on contact lens wear, as well as improved vision through glasses

Conclusion

The CAIRS procedure is an advancement in the management of patients with keratoconus as it improves quality of vision, uncorrected vision, corneal shape, and can help decrease uncorrected refractive error. However, these patients should still be considered for specialty CLs to allow for further visual improvement.

References:

Jacob S, Patel SR, Agarwal A, Ramalingam A, Saijimol AI, Raj JM. Corneal Allogenic Intrastromal Ring Segments (CAIRS) Combined With Corneal Cross-linking for Keratoconus. *J Refract Surg*. 2018;34(5):296-303. doi:10.3928/1081597X-20180223-01

Montalt JC, Porcar E, España-Gregori E, Peris-Martínez C. Visual quality with corneo-scleral contact lenses after intracorneal ring segment (ICRS) implantation for keratoconus management. *Cont Lens Anterior Eye*. 2019;42(1):111-116. doi:10.1016/j.clae.2018.07.006

Parker JS, Dockery PW, Parker JS. Flattening the curve: manual method for corneal allogenic intrastromal ring segment implantation. *J Cataract Refract Surg*. 2021;47(11):e31-e33. doi:10.1097/j.jcrs.0000000000000555

Rathi VM, Mandathara PS, Dumpati S, Sangwan VS. Scleral lens after intracorneal ring segments in patients with keratoconus. *Cont Lens Anterior Eye*. 2018;41(2):234-237. doi:10.1016/j.clae.2017.10.013