

## Research Article

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## Cataract Surgery on an Octogenarian Patient with a History of Hexagonal Keratotomy

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**ABSTRACT**

An 81-year-old female patient presents with poor vision and seeks options to improve her vision. The patient received a hexagonal keratotomy, an early refractive surgical technique used to improve hyperopia, more than 45 years prior. Due to the patient's history, preemptive measures are taken to ensure corneal stability. Upon examination, dry eye disease, nuclear sclerosis, and cortical changes are present in both eyes. The patient has severe, irregular astigmatism. Preoperatively, aggressive treatment for dry eye disease was undertaken until stable biometry could be acquired. Femtosecond laser-assisted cataract surgery was performed sequentially at a one-week interval. The patient had bilateral small-aperture lenses (Aphera/IC8 Bausch Health). Aggressive dry eye treatment continued postoperatively, and the patient's UCVA at distance was 20/30; at intermediate was 20/30; and at near was 20/30.

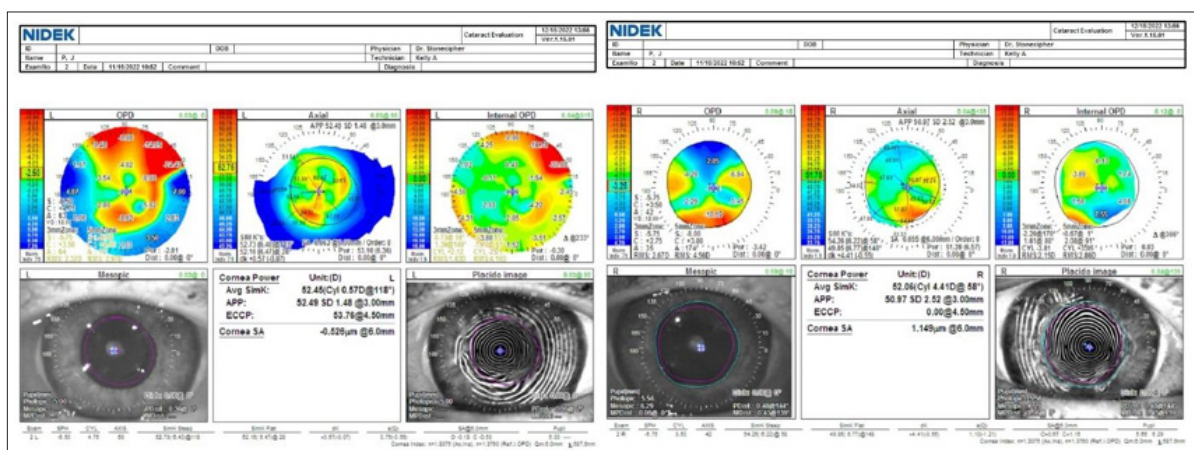
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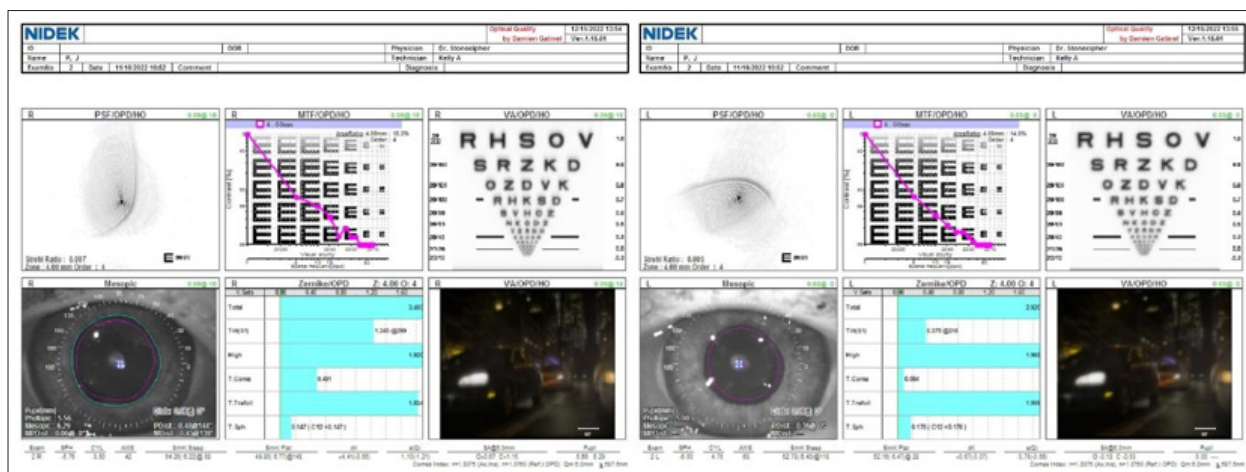
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**Keywords:** Cataract, Hexagonal Keratotomy, Cataract Surgery, Irregular Astigmatism, Small Aperture Lens (Aphera/IC8)**Introduction**

More and more patients are presenting for cataract surgery with a surgical history of incisional refractive surgery, such as radial keratotomy, astigmatic keratotomy, a combination of the two, and hexagonal keratotomy. A large majority of these patients present with severe hyperopia, hyperopic astigmatism, and irregular astigmatism. Cataract surgery may be the only opportunity to restore the functional quality and quantity of vision. This patient's history includes a bilateral hexagonal keratotomy in which six linear incisions in the shape of a hexagon were made into the stroma layer of the cornea. A hexagonal keratotomy is a refractive surgical technique used to fix hyperopia by creating a controlled ectasia of the cornea. Unfortunately, in many cases, regression of effect and severe corneal astigmatism were the results. The patient presents with a best corrected visual acuity of 20/50 in the right eye and 20/70 in the left eye, along with a refraction of  $-4.25 + 4.00 \times 0.90^\circ$  and  $-4.00 + 4.25 \times 0.69^\circ$ , respectively. Dry eye disease is also found in both eyes by a lissamine green staining nasally, centrally, and temporally grade  $\frac{3}{4}$  OU, and the patient has a tear breakup time of two seconds. The potential acuity measure shows 20/40 in both eyes. The patient's retinas were normal by OCT and indirect examination. The pachymetry reads 565  $\mu\text{m}$  in the right eye and 560  $\mu\text{m}$  in the left eye. Below are the topographic findings shown in Figures 1 and 2:



**Figure 1:** In these figures, we see severe irregular topographic rings consistent with the patient's dry eye disease and severe irregular astigmatism in both eyes. The central keratometric values are severely steepened, related to the hexagonal keratotomy.



**Figure 2:** In this figure, we see the overall poor quality of the patient's point spread function in both eyes, and the visual acuity simulation and optical quality at night are severely affected. The modulation transfer function is dramatically reduced, and the higher-order aberrations are over 1.9 microns in both eyes.

### Materials and Methods

The patient's dry eye disease was treated using punctal plugs, low-level light therapy combined with intense pulsed light therapy (Espansione Group), topical cyclosporine (Cequa, Sun Pharmaceuticals), and Meibo tears (Bausch Health). An IOLMaster 700 and the Nidek OPD III were used before and after dry eye disease treatment to conduct a final corneal topography and tomography with biometry. Multiple diagnostics were required before stable diagnostics and biometry could be obtained. The cataract surgery was performed using a LenSx femtosecond laser system (Alcon) and a Centurion phacoemulsification system (Alcon). A 3-mm incision and a large sleeve irrigation and aspiration were used to accommodate the IC8/Aphera intraocular lens. After waiting one week, a similar surgery with the implantation of an IC8/Aphera IOL was placed in the patient's second eye at her request.

### Results

One year after the surgery, the patient's best corrected visual acuity is 20/25 in both eyes, and her uncorrected visual acuity is 20/30 in the individual eyes. Her current UCVA at distance is 20/30 (logMAR 0.2), intermediate is 20/30 (logMAR 0.2), and near is 20/30 (logMAR 0.2). She notes that her preoperative glare and starburst have dramatically decreased. The patient's postoperative care was standard, and aggressive treatment of dry eye disease continues.

### Discussion

Hexagonal keratotomies are not commonly practiced today due to the high complication rate. Many postoperative complications have been reported, including glare, photophobia, uneven astigmatism, and corneal perforations, all of which our patient had previously experienced [1]. A commonality of irregularity in wound healing and anterior displacement of the cornea adjacent to the incisions was recorded in the same study. Vinger et al report 28 cases of ruptured globes resulting from various activities in patients with a history of incisional keratotomies [2]. Of the 28 patients, only eight concluded with a visual acuity of 20/40 or better, and the rest of the patients experienced significantly worse loss of best corrected visual acuity. Due to these and numerous other complications, hexagonal keratotomies are considered unpredictable and should not be practiced until further research

has been made to determine the safety of this procedure [1,2,3]. Since there are only a few documented cases of cataract surgery following hexagonal keratotomies, the patient's improved vision after this surgery is important for this case study and the treatment of this specific set of conditions. Patients with poor vision who have had an incisional keratotomy in the past will become more common, and with limited options to improve vision, having cataract surgery is a viable treatment. As our patient's surgical history resulted in severe astigmatism of both eyes as well as glares and starbursts, establishing stable biometry and running diagnostics were done to ensure an effective yet minimally invasive cataract surgery. The patient's dry eye condition was treated with immunomodulators (cyclosporine), artificial tears, and photobiomodulation red low-level light therapy (Espansione). In a study correlating the treatment of meibomian gland dysfunction with low-level light therapy, Stonecipher et al recorded a clinically significant increase in the average tear breakup time of 230 patients from 4.4 seconds pre-treatment to 8 seconds post-treatment [4]. The results in our patient are favorable, suggesting the preoperative and postoperative methods used are effective for this case of cataract surgery.

Although cataract surgery after hexagonal keratotomies or other incisional keratotomies has been performed for years, individuals who had these early ophthalmic procedures in the later half of the 20th century will likely require similar treatments as age-related cataracts start to develop. In two identical but independent cases, patients with the same history as our patient achieved favorable UCVA's. Devgan records a case in which a 75-year-old patient initially had an unstable, scarred cornea and severe astigmatism because of a hexagonal keratotomy surgery done decades prior; with the implantation of a toric lens, the patient adapted to the same postoperative UCVA as our patient, 20/30 [5]. Casebeer et al report a patient's improved UCVA following cataract surgery with a history of hexagonal keratotomy [6]. Our patient's improved UCVA, combined with positive findings by Devgan and Casebeer et al, suggests that cataract surgery is a safe and efficient means of helping these individuals see better after a complicated hexagonal keratotomy. To improve vision in cataract patients with a history of incisional keratotomy, more research on this combination of conditions is recommended.

## References

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