Femtosecond Laser-Assisted Cataract Surgery After Implantation of a Transparent Near Vision Corneal Inlay

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ABSTRACT

PURPOSE: To describe two cases of successful femtosecond laser-assisted cataract surgery in patients with a transparent hydrogel corneal inlay (Raindrop Near Vision Inlay; ReVision Optics, Inc., Lake Forest, CA).

METHODS: Case report.

RESULTS: In both cases, femtosecond laser-assisted cataract surgery was performed with the inlay in place. The femtosecond laser pulses were delivered without difficulties, and the Raindrop inlay did not interfere with the visualization of intraocular structures during surgery. Following implantation of a monofocal intraocular lens targeted for plano, both patients experienced improvements in their uncorrected distance visual acuity and regained near vision.

CONCLUSIONS: These two cases suggest that the presence of the Raindrop inlay left in situ does not preclude successful femtosecond laser-assisted cataract surgery.


Cataract surgery has dramatically evolved from large-incision extracapsular extraction to microincision phacoemulsification and more recently to femtosecond laser-assisted cataract surgery. Femtosecond laser-assisted cataract surgery has potential advantages over manual surgery, such as creating corneal incisions of reproducible shape and size, improving reliability and reproducibility of the capsulotomy, and reducing ultrasound phacoemulsification energy delivered to the eye after pre-softening the crystalline lens.

The past few decades have seen improvements in the design of and materials used for corneal inlays, and current devices have shown success for the treatment of presbyopia. Corneal inlays are typically implanted in the non-dominant eye deep into the corneal stroma under a flap or a pocket. The Raindrop Near Vision Inlay (ReVision Optics, Inc., Lake Forest, CA) is a hydrogel inlay implanted under a femtosecond LASIK flap at one-third of central corneal thickness. The Raindrop inlay is designed to change the shape of the cornea (steepens in the center to create a profocal cornea) to provide improved near and intermediate vision. The hydrogel inlay is transparent and biocompatible with similar water content (approximately 80%) and refractive index (1.376) as the cornea. The Raindrop inlay is currently under investigation in the United States and Mexico.

This article describes two cases that required cataract surgery after implantation of the Raindrop inlay, performed using femtosecond laser-assisted cataract surgery.

CASE REPORTS

Case 1
A 56-year-old woman had implantation (surgeon: GP) of the Raindrop inlay in April 2010, as part of the US IDE Trial. The patient had good uncorrected near visual acuity (UNVA) of 20/32 or better during the first 2 postoperative years, but developed age-related posterior subcapsular cataract (Figure 1) approximately 3 years (34 months) after implantation. The patient complained of new-onset glare and decreased vision (manifest refraction was +0.25 -0.50 × 075; corrected distance visual acuity [CDVA] was 20/32). Intraocular lens (IOL) power calculation was accomplished using the LENSTAR EyeSuite (Haag-Streit, Koeniz, Switzerland) measurements, with the exception of keratometry, for which pre-inlay values were input manually into the LENSTAR software. Cataract surgery was performed with the LenSx Laser System (Alcon Laboratories, Inc., Fort Worth, TX) using the SoftFit patient interface. Capsulotomy (4.8 mm) and lens fragmentation were achieved without problems, and all cuts were complete without tags or uncut areas (Figure 2). Phacoemulsification was completed as usual and a monofocal IOL (Alcon MA60AC; Alcon Laboratories, Inc.) was implanted (Figure 3) under complete visualization of the capsulotomy edge with a plano target refraction. The postoperative period was uneventful; at 1 month, monocular uncorrected distance visual acuity (UDVA) and UNVA were 20/25 and the manifest refraction was -0.50 -0.75 × 020. At the 3-month follow-up visit, UDVA and UNVA in the eye with the
corneal inlay remained 20/25. The patient was entirely satisfied with the outcome and continues to have full range of vision, restoring her spectacle independence.

**Case 2**

A 52-year-old woman had implantation (surgeon: EBG) of the Raindrop inlay in Monterrey, Mexico, in February 2011. In April 2013 (26 months postoperatively), she complained of decreased distance vision. The manifest refraction in this eye shifted more myopic to -4.00

-1.50 × 180, achieving a CDVA of 20/60 only. The slit-lamp examination revealed a posterior subcapsular cataract on the visual axis with all other ocular health parameters within normal limits. The cataract was determined to be age related because the patient did not have any comorbidities and was not chronically using steroids. IOL power calculation was conducted in the same manner as the previous case, using the IOLMaster (Carl Zeiss Meditec AG, Germany) for all parameters with the exception of keratometry, for which the surgeon used pre-inlay keratometry values obtained using the Pentacam (Oculus Optikgeräte, Wetzlar, Germany).

As in the previous case, the patient underwent cataract surgery (30 months after Raindrop inlay implantation) using the LenSx for capsulotomy and lens fragmentation without issues; no modifications were made to phacoemulsification and good visualization of the intraocular structures was maintained throughout the entire procedure. A monofocal IOL (Alcon MA60AC; Alcon Laboratories, Inc.) with a plano target refraction was implanted without complications. Three months after cataract surgery, UDVA was 20/32, UNVA was 20/32, and manifest refraction was +1.00 -1.25 × 180. The patient was satisfied with the outcome and continues to have full range of functional vision.

**DISCUSSION**

Cataract surgery has evolved to become a refractive procedure. New technologies and advances in...
IOL power calculation have had a significant impact on visual outcomes. The growth in femtosecond laser-assisted cataract surgery as an option for cataract surgery imposes challenges for new technologies that may preclude laser delivery to intraocular structures. Corneal inlays are new devices that intend to improve near and intermediate vision. Demographically, patients with corneal inlay tend to be younger (45 to 60 years old) than patients with cataract, but eventually will develop cataracts, which require surgical treatment. More importantly, because they are placed in the cornea (on the visual axis), they may interfere with light transmission into the eye (eg, delivery of laser energy), or may preclude adequate visualization of the intraocular structures during surgery.

Previous reports on cataract surgery after implantation of other corneal inlays are limited. Tan and Mehta10 described cataract surgery in two patients who had implantation of the KAMRA inlay (Acufocus, Irvine, CA), an opaque corneal inlay using small aperture optics to correct presbyopia. The authors performed manual cataract surgery and reported that although cataract surgery with the KAMRA inlay left in place was not technically more difficult, the procedure may be improved by additional ocular rotations during capsulorhexis and phacoemulsification to improve surgical visualization. In our cases, however, we found that the Raindrop inlay did not interfere with the visualization of intraocular structures and thus cataract surgery was not technically more difficult, nor did it require additional ocular rotations. Additionally, when performing femtosecond laser-assisted cataract surgery, the transparent inlay allowed effective delivery of the femtosecond laser energy, making complete cuts without tags. The refractive outcome in these two cases seemed variable because both patients were within 1.0 diopter of intended manifest refraction spherical equivalent. However, the fact that none of these cases ended within 0.5 diopter of plano shows that IOL power calculation is an area of improvement for future cases.

Although this case series is too small to draw any firm conclusions regarding safety and visual outcomes, as well as accurate IOL power calculation, it does suggest that the presence of the Raindrop inlay is not a barrier to successful cataract surgery with femtosecond laser-assisted cataract surgery.

**AUTHOR CONTRIBUTIONS**

Study concept and design (EBG, GDP); data collection (EBG, GDP); writing the manuscript (EBG); critical revision of the manuscript (GDP); supervision (EBG, GDP)

**REFERENCES**