

Combined Intacs and Posterior Chamber Toric Implantable Collamer Lens Implantation for Keratoconic Patients with Extreme Myopia

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- **PURPOSE:** To evaluate the results of combined Intacs (Addition Technology, Fremont, California, USA) and posterior chamber toric implantable Collamer lens [ICLs] (Visian ICL; STAAR Surgical, Monrovia, California, USA) implantation in keratoconic patients with extreme myopia and irregular astigmatism.
- **DESIGN:** Prospective, single-center, noncomparative, interventional, consecutive case series.
- **METHODS:** Three eyes of two consecutive highly myopic keratoconic patients who had undergone posterior chamber toric ICLs implantation after Intacs implantation. Implantation of posterior chamber toric ICLs was performed at intervals between six and 10 months after Intacs implantation. Uncorrected visual acuity (UCVA), best spectacle-corrected visual acuity (BSCVA), refraction, topographic findings, adverse events, and postoperative complications were noted.
- **RESULTS:** No intraoperative or postoperative complications were observed. An improvement in UCVA and BSCVA was found after the Intacs and toric Visian ICL procedures in all eyes. All eyes were emmetropic within 1 diopter (D), whereas the mean manifest refractive spherical equivalent refraction reduced from -18.50 ± 2.61 D (range, -16.75 to -21.50 D) to 0.42 D (range, plano to -0.75 D). The mean difference between preoperative and last follow-up UCVA and BSCVA was a gain of 6.67 ± 1.15 lines (range, gain of six to eight lines) and 4.33 ± 2.52 lines (range, gain of two to seven lines), respectively.
- **CONCLUSIONS:** Combined Intacs and posterior chamber toric phakic Visian ICL implantation in a two-step procedure is an effective method for correcting keratoconic patients with extreme myopia. (Am J Ophthalmol 2007;144:387–389. © 2007 by Elsevier Inc. All rights reserved.)

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INTRASTROMAL CORNEAL RING SEGMENTS (INTACS; Addition Technology, Inc, Fremont, California, USA) were used first in patients with low myopia. Because of the tissue-saving character of this technique, its application may be an alternative treatment option in keratoconic patients in which refractive surgery is not suitable. Several studies demonstrate the efficacy of Intacs in keratoconic eyes^{1,2} and post-laser in situ keratomileusis corneal ectasia.^{3,4}

The purpose of corneal ring implantation in keratoconic patients is to reshape the abnormal cornea to improve the topographic abnormalities and visual acuity. Despite the encouraging results in corneal ectatic disease after Intacs implantation, most of the patients need spectacles or contact lenses to correct residual refractive myopia or astigmatism. By definition, techniques other than laser corneal refractive surgical procedures should be taken into consideration for the correction of residual refractive error in post-Intacs keratoconic patients. We present a small case series of combined Intacs and posterior chamber toric phakic Visian implantable Collamer lens (ICLs) in keratoconic patients with extreme myopia and irregular astigmatism.

METHODS

IN THIS PROSPECTIVE, NONRANDOMIZED CLINICAL CASE series from Dunya Eye Hospital, Istanbul, Turkey, we evaluated the results of combined Intacs and posterior chamber toric ICLs (Visian ICL; STAAR Surgical, Monrovia, California, USA) implantation in keratoconic patients with high myopia (three eyes of two patients, one female and one male). All the patients had a normal systemic history and normal physical examination results, as well as an absence of any history or physical signs of ocular disease with the exception of keratoconus and myopia.

Before and after the intrastromal corneal ring and Visian ICL surgeries, a comprehensive ophthalmic examination was performed, including uncorrected visual acuity (UCVA), best spectacle-corrected visual acuity (BSCVA), manifest and cycloplegic refraction, and computer-assisted videokeratoscopy using the Orbscan II (Bausch & Lomb, Rochester, New York, USA) and Wavelight Topolyzer

(Wavelight Technology AG, Erlangen, Germany). The UCVA and BSCVA were obtained using a Snellen chart.

• **INTACS IMPLANTATION PROCEDURE:** The surgical procedure was performed under topical anesthesia. Corneal thickness was measured during surgery at the incision site and peripherally in the cornea with ultrasonic pachymetry (Sonagage 50 Hz; Sonogage Inc, Cleveland, Ohio, USA) along the ring placement markings. Two Intacs segments (0.45 mm in thickness) were inserted uneventfully at 70% of the thinnest part of the corneal thickness, using the femtosecond laser⁵ (15 KHz; Intralase Corp, Irvine, California, USA). A disposable vacuum instrument was inserted to minimize decentration. The disposable glass lens was applanated to the cornea to fixate the eye and to help maintain a precise distance from the laser head to the focal point. The pulse duration was 600 femtoseconds. The intralase settings were: inner diameter, 6.5 mm; outer diameter, 7.3 mm; entry cut thickness, 1 μ m; ring energy, 1.30; entry cut energy, 1.30. Tunnel creation took eight seconds. The original insertion was reopened with Sinsky hooks. The procedure was uneventful.

After surgery, antibiotic steroid eye drops four times daily for two weeks were prescribed. The patients were instructed to avoid rubbing the eye and to use preservative-free artificial tears frequently. Visian ICL implantation was performed at least six months after the Intacs implantation.

• **TORIC VISIAN ICL IMPLANTATION:** To control for potential cyclotorsion on lying supine, we marked the zero horizontal axis at a slit-lamp while the patient was sitting upright. Each patient received two peripheral iridectomies one week before the surgery using a neodymium:yttrium-aluminum-garnet (Nd:YAG) laser. Implantable Collamer lens (ICLs) were sized according to corneal white-to-white and anterior chamber depth (ACD) measurements by Orbscan II. The toric Visian ICL was inserted through a horizontal temporal 3-mm corneal incision to the anterior chamber (AC) and allowed to unfold slowly. With the Vukich Visian ICL manipulator (Asico LLC, Westmont, Illinois, USA), the four footplates were placed underneath the iris. Adjustment of the implant, if necessary, was accomplished by a gentle movement touching the Visian ICL at the junction of the haptic and optic. Correct positioning of the Visian ICL in the center of the pupillary zone was verified before an intraocular miotic was used to decrease pupil size. Any remaining viscoelastic was irrigated out of the AC with balanced salt solution.

RESULTS

• **CASE 1:** A 32-year-old woman had unilateral advanced keratoconus with high myopia in the right eye and contact lens intolerance. The UCVA was counting fingers, and the

BSCVA was 20/200. The manifest refraction was $-18.00 - 7.00 \times 030$, central corneal pachymetry was 389 μ m (corneal thinnest point was 353 μ m), endothelial cell density was 2254 cell/mm², ACD was 4.10 mm, and keratometric values were 51.8 @ 29/57.9 @ 119. Two Intacs segments (0.45 mm) were implanted (with the incision made in the topographic steep axis). Six months after Intacs implantation, a significant improvement in BSCVA was observed (from 20/200 to 20/50) with a reduction in manifest refraction ($-15.25 - 2.00 \times 55$) and keratometric astigmatism (from 6.1 to 2.5 D), whereas a toric Visian ICL was implanted according to the post-Intacs manifest refraction. Six months after combined Intacs and toric Visian ICL implantation, the patient was emmetropic ($0.25 - 0.75 \times 010$), with an improvement in UCVA (from counting fingers to 20/40) and BSCVA (from 20/50 after Intacs to 20/40). Six months later, the refraction, UCVA, and BSCVA remained stable without any postoperative complications.

• **CASE 2:** A 36-year-old woman with bilateral advanced keratoconus and myopia was referred to our institute for evaluation. The patient had experienced contact lenses intolerance for the previous three months. Manifest refraction was $-15.50 - 3.50 \times 030$ and $-15.00 - 3.25 \times 135$ in the right and left eyes, respectively. UCVA was counting fingers bilaterally, whereas BSCVA was 20/63 and 20/80 in the right and left eyes, respectively. Keratometric values were 56.6 @ 22/59.3 @ 112 and 54.9 @ 174/58.4 @ 84 in the right and the left eyes, respectively. Corneal thinnest point was 354 μ m, endothelial cell density was 2165 cell/mm², and ACD was 3.50 mm in the right eye, whereas in the left eye, corneal thinnest point was 350 μ m, endothelial cell density was 2119 cell/mm², and ACD was 3.53 mm. Two Intacs segments (0.45 mm) were implanted (with the incision made in the topographic steep axis) in both eyes. A significant improvement in topographic findings was observed in both eyes after Intacs implantation, with an increase in BSCVA (from 20/63 to 20/50 and from 20/80 to 20/40 for the right and left eyes, respectively; [Figure](#)). Ten months after Intacs implantation, toric Visian ICLs were implanted in both eyes for residual myopia and astigmatism correction. Three months later, a significant improvement in manifest refraction was found in both eyes (from $-10.75 - 2.00 \times 180$ to $-0.25 - 1.00 \times 35$ and from $-11.25 - 3.75 \times 115$ to $-0.25 - 1.25 \times 010$ in the right and left eyes, respectively) with an improvement in UCVA (from counting fingers in both eyes to 20/63 in each eye) and BSCVA (from 20/50 to 20/40 and from 20/40 to 20/32 in the right and left eyes, respectively).

No intraoperative or late postoperative serious complications occurred in this series of patients (such as segment extrusion, cornea neovascularization, intraocular pressure increase, or Visian ICL rotation). Eight months later, the refraction, UCVA, and BSCVA remained stable without any late postoperative complication.

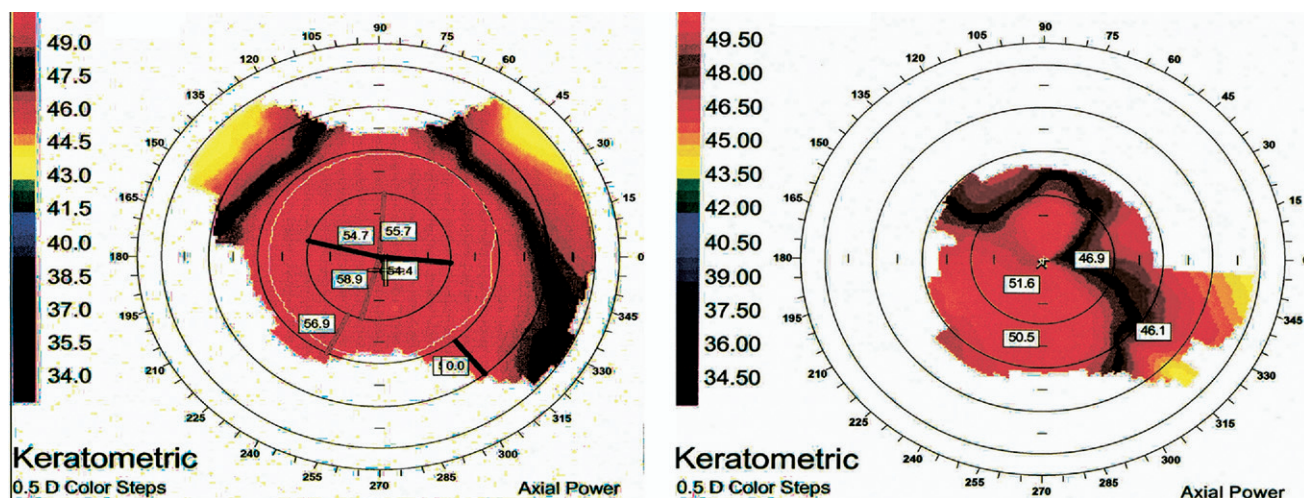


FIGURE. Anterior topographic findings (Left) before and (Right) six months after Intacs implantation.

DISCUSSION

KERATOCONUS IS A CORNEAL DISEASE CHARACTERIZED BY progressive corneal steepening. The cornea takes an irregular conical shape, causing a decrease in visual acuity. Despite the encouraging results after Intacs implantation in keratoconic patients, the predictability of such an approach is still low. Especially in keratoconic patients with high myopia and contact lens intolerance, spectacles cannot offer to these patients an improvement in visual acuity, whereas laser refractive surgery is contraindicated.

In a previous article, Colin and associates reported a post-Intacs keratoconic patient with residual myopia (-8.25 D) that was corrected with implantation of an anterior chamber phakic refractive lens.⁶ No intraoperative or postoperative complications were observed. In this case series, a combined technique of Intacs and toric Visian ICL was used to treat keratoconus patients with extreme myopia and astigmatism in a two-step procedure.

In the first step, Intacs implantation was performed to reshape and minimize corneal irregularities, whereas in the second step, according to the post-Intacs topographic findings and residual myopia and astigmatism, a toric Visian ICL was implanted. No intraoperative or postoperative complications were observed in this small case series of eyes (such as cataract or glaucoma), whereas an improvement in UCVA and BSCVA were observed with a significant reduction in manifest refraction. Both steps were uneventful in all eyes, whereas toric Visian ICL implantation did not result in any difficulties (especially in keratoconic eyes in which the anterior chamber is deeper) in relation to the previous Intacs segment surgery. In conclusion, despite the limitations placed by the small number of patients, the combination of Intacs and toric Visian ICL implantation in a two-step procedure seems to be a reasonably surgical treatment option in keratoconic patients with high myopia.

THE AUTHORS INDICATE NO FINANCIAL SUPPORT OR FINANCIAL CONFLICT OF INTEREST. INVOLVED IN DESIGN AND conduct of study (E.C., M.O., G.D.K., I.P.); collection, management, analysis, and interpretation of the data (E.C., E.A., N.T., D.B.); and preparation, review, and approval of the manuscript (E.C., M.O., G.D.K., V.D., N.T., I.P.). All patients were appropriately informed of risks and benefits before operation, and they gave their written informed consent in accordance with Institutional Review Board of Dunya Eye Hospital, Istanbul, Turkey, according to the tenets of the Declaration of Helsinki.

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Biosketch

George D. Kymionis, MD, PhD, graduated from the Medical School of University of Athens, Athens, Greece and three years later finished his first PhD (apoptosis in human carotid atheroma) in the same university. He worked as a fellow in Ophthalmology in Vardinoyiannion Eye Institute of Crete, Crete, Greece, for several years in which he finished his second PhD (ocular rigidity in AMD patients). Dr Kymionis has concluded his residency training in the University Hospital of Crete, and is currently doing a research fellowship at Bascom Palmer Eye Institute in Miami, Florida.



Biosketch

Efekan Coskunseven was born in 1968 in Nazilli, Turkey. He graduated from Medical School of Ege University, Izmir, Turkey and specialized in Ophthalmology in the Medical School of Dicle University, Diyarbakir, Turkey. Dr Coskunseven is the director of refractive surgery department in Dunya Eye Hospital, Istanbul, Turkey since 2003.