Management of Corneal Ectasia After Laser in situ Keratomileusis With INTACS

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ABSTRACT

PURPOSE: To evaluate the safety and efficacy of intrastromal corneal ring segments (ICRS, INTACS, Keravision) for the correction of corneal ectasia after laser in situ keratomileusis (LASIK).

METHODS: In this prospective, noncomparative case series, INTACS were implanted in three eyes (two patients) that were ectatic after LASIK. Mean follow-up was 8.7 months (range, 8 to 10 mo).

RESULTS: No intraoperative complications occurred. After INTACS implantation, uncorrected visual acuity ranged from 20/20 to 20/25 at 6 months and remained stable until 9 months. Mean postoperative spherical equivalent refraction was 0.50 D at 1 month and no significant changes appeared up to 9 months after INTACS implantation. After INTACS implantation, no eye lost any lines of Snellen spectacle-corrected visual acuity and two eyes gained from one to two lines. There was an increase in topographical regularity in all three eyes.

CONCLUSION: Implantation of INTACS in eyes with corneal ectasia after LASIK resulted in good refractive outcome, absence of complications, and improvement in visual acuity. [*J Refract Surg* 2002;18:43-46]

Despite many studies that support the efficacy of laser in situ keratomileusis (LASIK), there is increasing concern regarding the occurrence of postoperative keratectasia. LASIK substantially weakens the mechanical strength and effective thickness of the cornea. There is concern that at some point the tensile strength of the cornea might be reduced to a level that predisposes postoperative ectasia. Since 1998, when Seiler[1] published the first article regarding this complication, we have yet to elucidate the cause and mechanism of this phenomenon.

Intrastromal corneal ring segments (INTACS, Keravision) were designed to achieve a refractive adjustment by flattening the central corneal curvature while maintaining a prolate aspheric shape in the central optical zone.[2,3] Furthermore, unlike excimer laser refractive techniques, INTACS preserves corneal tissue while maintaining lucency in the central optical zone. Several studies have demonstrated the efficacy of INTACS for correcting low myopia, and in keratoconic eyes, INTACS implantation has resulted in an increase in topographical regularity and improvement in uncorrected visual acuity (UCVA).[4]

By virtue of their inherent tissue saving properties, INTACS may represent an interesting surgical alternative in patients with corneal ectasia after LASIK.[5,6] We present preliminary results of three eyes (two patients) with corneal ectasia after LASIK, treated with INTACS implantation.

PATIENTS AND METHODS

Patient Selection

Two consecutive patients (three eyes) with corneal ectasia after LASIK were evaluated. Both were females (34 and 40 years old); one had bilateral and the other unilateral ectasia. Each had received LASIK 1 year earlier, with attempted corrections of -8.50, -9.25 and -9.00 diopters (D), after creation of a nasally hinged corneal flap 8.5 mm in diameter using an automated microkeratome (Flapmaker Disposable Microkeratome, Refractive Techologies, Cleveland, OH). A 4.0 to 6.0-mm-diameter ablation was then applied to the stromal bed (MEL 60 excimer laser, Aesculap-Meditec, Jena, Germany). Ectasia was diagnosed by slit-lamp appearance of corneal thinning, unstable

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topographical steepening (EyeSys Technologies, Version 3.1, EyeSys Premier, Irvine, CA) (Fig.1), corneal thickness by ultrasonic pachymetry (DGH 5100 Techology, Inc, Cleveland, OH), decreased visual acuity, unstable refraction, and posterior corneal steepening (Orbscan Slit Scanning Topography/ Pachymetry System, Orbtek Inc, Salt Lake City, UT) (Fig 2A).

Surgical Procedure

Informed consent was obtained from both patients prior to surgery. The surgical procedure was performed under topical anesthesia and was technically identical to that used in the correction of low myopia, except that care was taken to prevent the radial incision from crossing the old flap edge (it was placed central to this, approximately 1.0 mm from the limbus). Corneal thickness was measured at the incision site with ultrasonic pachymetry and the diamond knife was set at 70% of the peripheral corneal depth. A 1.2-mm radial incision was created and the floor of the incision was visualized using two Sinskey hooks and a Suarez spreader. Incision depth was checked with gauges and centration was verified. Two intrastromal pockets were created using a pocketing lever, stromal spreader, and clockwise and anticlockwise dissection glides. Two hemichannels (right and left) were created using clockwise and anticlockwise dissectors under suction created by a vacuum centering guide. The two PMMA segments (with thickness depending on the residual refraction) (Table) were implanted in the clockwise and counterclockwise tunnels, maintaining a space of 2.0 mm between their ends and

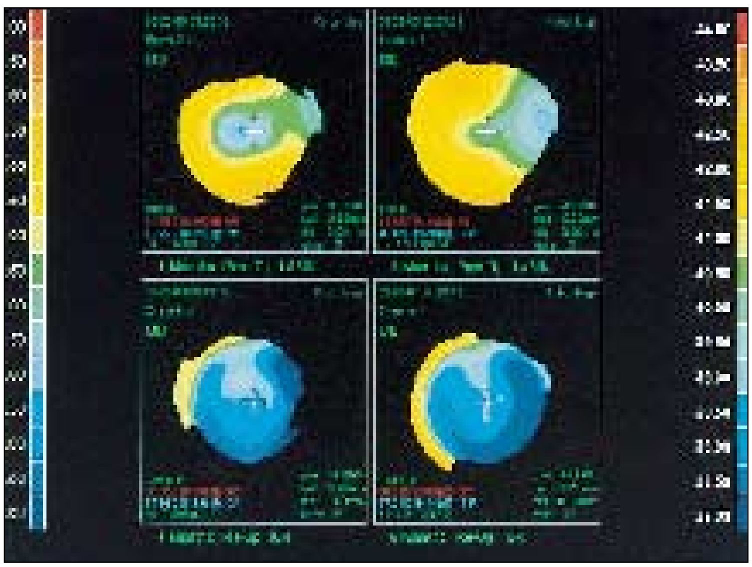

Figure 1. Four-map trend demonstrates topographic changes after LASIK (unstable steepening and eccentric displacement of the ablation zone) and after INTACS implantation (uniform increase in the optical zone, which remained stable over time).

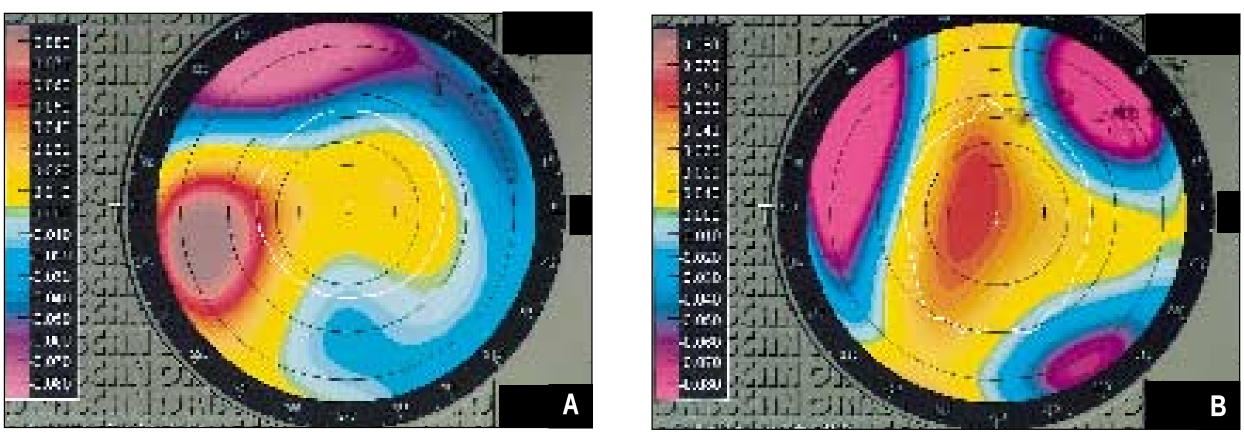

Figure 2. Corneal topography of the posterior corneal surface (Orbscan) reveals the reduction of posterior corneal ectasia after INTACS implantation between **(A)** the postoperative LASIK period and **(B)** after INTACS implantation (sixth month after INTACS implantation).

Table
Findings Before and After INTACS Implantation for Corneal Ectasia in Three Eyes

Patient No. (eye)	Preoperative (After LASIK) 1 month	Last Follow-up	Postoperative (After INTACS) 1 month	3 months	6 months	9 months
Uncorrected Visual Acuity						
1 (OD)	20/20	20/125	20/25	20/25	20/20	20/20
2 (OD)	20/25	20/200	20/25	20/25	20/25	20/25
2 (OS)	20/25	20/200	20/25	20/20	20/20	20/20
Best Spectacle-corrected Visual Acuity						
1 (OD)	20/20	20/25	20/20	20/20	20/20	20/20
2 (OD)	20/20	20/25	20/25	20/25	20/25	20/25
2 (OS)	20/20	20/32	20/20	20/20	20/20	20/20
Spherical Equivalent Refraction (D)/INTACS thickness (mm)						
1 (OD)	-0.50	-3.00/0.30	-0.75	-0.75	-0.50	-0.25
2 (OD)	-0.75	-3.50/0.40	-0.25	-0.50	-0.25	-0.50
2 (OS)	-0.75	-3.75/0.40	-0.50	-0.25	-0.25	-0.25
Mean Keratometric Power of the Anterior Surface (D)						
1 (OD)	40.8	42.5	38.3	38.0	37.7	38.2
2 (OD)	33.2	35.7	33.1	32.9	33.5	32.9
2 (OS)	34.6	37.1	34.9	34.5	33.9	34.2
Posterior Best-fit Sphere (D)						
1 (OD)	51.4	53.0	51.5	51.0	51.7	51.3
2 (OD)	47.8	49.1	47.9	48.5	48.3	48.1
2 (OS)	46.1	48.3	45.7	46.1	45.9	46.5

1.5 mm between the opposite edge of each segment and the edge of the incision. The INTACS segments ultimately settled on the inner portion of the LASIK flap edge because of the standard 7.5-mm diameter of the ring.

After the stromal pocket had been carefully washed with balanced salt solution, the incisions were closed with a single interrupted 10-0 nylon suture. All procedures were uneventful, and no disruption of the LASIK flap occurred. Postoperatively, all eyes received antibiotic/corticosteroid combination eye drops QID for 1 week. In addition, all patients were instructed to use preservative-free artificial tears frequently.

Follow-up Evaluation

All eyes were examined preoperatively. Postoperative examinations were scheduled for days 1, 3, and 15, and months 1, 3, 6, and 9. Uncorrected visual acuity (UCVA), best spectacle-corrected visual acuity (BSCVA), and manifest refraction were measured. In addition, a questionnaire given to all patients recorded subjective symptoms.

RESULTS

Follow-up for both patients was 8.7 months. The results of visual acuity (UCVA, BSCVA), refraction, and mean keratometry are shown in the Table. In all eyes, central flattening of the ectatic cornea was observed. The reduction of corneal ectasia was evident on corneal topography (anterior and posterior) maps (Figs. 1,2).

Visual Acuity

Nine months after INTACS implantation, uncorrected visual acuity was 20/25 to 20/20 in all three eyes. No eye lost any Snellen line of spectacle-corrected visual acuity and two eyes gained from one to two lines after INTACS implantation (Table).

Spherical Equivalent Refraction

Mean postoperative spherical equivalent refraction before INTACS implantation was 3.42 D (range, -3.00 to -3.75 D) and after INTACS implantation was 0.50 D (range, 0.25 to 0.75 D) at the first month. Nine months postoperative, all eyes were within ±0.50 D of emmetropia (Table). There were no overcorrected eyes.

Subjective Symptoms

The subjective response for glare and halos was evaluated on a scale from 1 to 3: 1: deterioration, 2: no improvement, 3: improvement of glare and halos. An improvement of such symptoms was observed in all eyes.

DISCUSSION

Over the last couple of years, there has been increasing concern regarding the occurrence of corneal ectasia after LASIK. We described our limited yet relatively successful experience with INTACS for three eyes with corneal ectasia after LASIK. After a follow-up of 9 months, an improvement in refractive outcome in all eyes was observed, with significant improvement in UCVA and topographic regularity. No eye lost any Snellen lines of spectacle-corrected visual acuity and two eyes gained from one to two lines after INTACS implantation. In addition to the improvement of the above parameters, a significant increase in optical zone after INTACS placement was observed in our patients (Fig 1). Based on subjective patient feedback, it is conceivable that in ectatic corneas, INTACS may improve the quality of vision and decrease symptoms of glare and halos.

An ectatic eye presents several intriguing management issues because of its inherent instability. It is also accepted that INTACS have been used to create predictable outcomes in eyes with low myopia and no coexisting ocular pathology. Our experience seems to show that even in eyes where biomechanical factors in the cornea have been changed by prior surgery, placement of INTACS may still provide outcomes that are not as unpredictable as the underlying problem would portend. Since long-term stability is a critical issue for any surgical intervention in ectatic corneas, it will be interesting to evaluate how INTACS affects corneal ectasia over more extended follow-up.

We conclude that INTACS could effectively be used to treat eyes with corneal ectasia after LASIK. Even though our results are preliminary, we think that INTACS could be an alternative technique offered to help patients. Further follow-up and additional cases must be reviewed to draw final conclusions about the efficacy of this surgical technique in corneal ectasia after LASIK.

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