Intraocular Lens Implantation and Laser in situ Keratomileusis (Bioptics) to Correct High Myopia and Hyperopia With Astigmatism

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ABSTRACT

PURPOSE: To analyze the refractive outcome of moderate to high myopic and hyperopic patients with astigmatism who underwent programmed refractive surgery: first lens phacoemulsification with intraocular lens implantation and 3 months later, laser in situ keratomileusis (LASIK).

METHODS: Four men and eight women (22 eyes) with a mean age 47.3 years (range, 38 to 75 yr), and an average spherical equivalent refraction of -11.76 D and +/6.22 D and (range, -17.50 to +8.50 D) underwent two refractive procedures. First, phacoemulsification of the lens with a self-sealing incision through clear cornea on the steepest topographic axis and implant of a multifocal intraocular lens in the bag was performed by two experienced surgeons. Second, LASIK was performed with the Nidek EC-5000 excimer laser and the Moria LSK-One microkeratome, by one surgeon. Eyes were divided into two different groups. In the first group, the IOL implanted was calculated to leave the eye slightly myopic, with final correction to be achieved with LASIK. In the second group, the IOL implanted was calculated to achieve emmetropia, correcting any residual refractive error with the laser.

RESULTS: After surgery, mean spherical equivalent refraction was -0.26 D (range, -0.375 to +1.50 D). Predictability of refractive outcome: 0 to -1.00 D, 63.66%; +0.25 to +1.00 D, 31.80%; +1.25 to +2.00 D, 4.54%. Mean residual refractive astigmatism was 0.30 D (range, 0 to 1.50 D). Uncorrected visual acuity of 20/20 or better was achieved in 18.3% of eyes; 20/40 or better in 81.8%. No eyes lost two or more Snellen lines of visual acuity and no adverse effects were observed.

CONCLUSIONS: Biopics (phacoemulsification with IOL implantation followed 3 months later by LASIK with the Nidek EC-5000 excimer laser) for correction of moderate to high myopia and hyperopia, with astigmatism, enabled us to treat the total refractive error and adjust final outcomes. [J Refract Surg 2001;17(suppl):S234]

Emmetropia should be the final objective of refractive surgery. When two operations are required (intraocular lens implantation [IOL] and laser in situ keratomileusis [LASIK]), the combination has been termed biopics.1,2 High levels of ametropia are not satisfactorily treated with corneal laser ablation alone. Advances in phacoemulsification, small incision surgery, IOLs, and viscoelastics have reduced the risks of lens surgery. Clear lens extraction is one of the surgical procedures to be considered for high myopia and hyperopia in presbyopic patients because of good visual outcome, and predictable and stable refractive results.3,4 LASIK is a good alternative to correct residual refractive error after intraocular implants, corneal procedures, or penetrating keratoplasty (Pershin KB, Pashinova NF. Fine tuning excimer laser correction after intraocular lens implantation and corneal transplantation. J Refract Surg 2000;16(suppl):S257-S260).5,6

We used a two-step surgery for the correction of high refractive errors: first, clear lens extraction with phacoemulsification and IOL implantation, and approximately 3 months later, LASIK. We report visual and refractive results of this combined technique.

PATIENTS AND METHODS

We performed LASIK in 22 eyes (12 patients), mean age 47.3 years (range, 38 to 75 yr). Twelve eyes had a residual refractive error after phacoemulsification surgery, and in 10 eyes, we planned a two-step refractive correction (IOL and LASIK).

After approval of our local ethics committee, written informed consent describing the risks and benefits of the procedures was obtained. All patients had a complete ophthalmological examination that
included uncorrected and spectacle-corrected visual acuity, subjective refraction, applanation tonometry, corneal topography (Atlas Eclipse 992 A10.1 version, Humphrey), slit-lamp biomicroscopy, tear film study, axial length measurement (Ocucan, Alcon, Ft. Worth, TX), and endothelial and corneal thickness (Topcon SP2000P). Before LASIK, eyes were required to have a minimum of 3 months with stable refraction after the IOL implantation.

IOL power was calculated using different formulas depending on axial length: Holladay-HofferQ (<20 mm), HofferQ-Holladay (20 to 22 mm), and SRK-II/SRK-T (>22 mm), aiming for a slight myopic shift in the planned group, avoiding hyperopic treatment.

IOL lens implantation surgery was performed by two experienced surgeons. Topical anesthesia was administered and lidocaine was injected into the anterior chamber. After viscoelastic, a self-sealing incision was made through clear cornea on the steepest topographic axis, phacoemulsification (Legacy 2000, Alcon, Ft. Worth, TX), and cortex aspiration were performed, implantation of a foldable IOL in the bag, and finally a stromal hydration of the corneal incision.

LASIK was performed using the Nidek EC-5000 excimer laser (Nidek, Gamagori, Japan) using an ablation rate of 0.60 μm/scan and a laser pulse repetition rate of 30 Hz for myopia and 46 Hz for hyperopia. Room temperature, and humidity were within acceptable limits.

All standardized LASIK surgery was performed by the same surgeon (LVG) using the Moria LSK-One microkeratome. An eye-tracking system for eye position detection and to monitor eye movement during laser ablation was used.

A transition zone of 7.5 mm, with an ablation zone of 6.0 mm for myopia and myopic astigmatism,
and a 5.5-mm ablation zone for hyperopia and hyperopic or mixed astigmatism were used.

**RESULTS**

Preoperative data for both groups are shown in Tables 1 and 2 and postoperative data in Tables 3 and 4.

One patient had a reoperation (4.54%).

After surgery, mean spherical equivalent refraction was +0.26 D (range, -0.375 to +1.50 D). Predictability of refractive outcome (Figs 1 and 2) was as follows: 63.63% of eyes were between 0 to -1.00 D: 31.81% from +0.25 to +1.00 D; 4.54% from +1.25 to +2.00 D. Mean residual absolute refractive astigmatism was 0.30 D (range, 0 to 1.50 D). The planned biotics group had an average previous value of 3.50 ± 1.70 D. After IOL implantation, mean astigmatism was 2.25 ± 1.10 D, and after LASK, it was 0.40 ± 0.25 D.

In the non-planned biotics group, mean preoperative astigmatism was 0.70 ± 0.60 D; 1.65 ± 0.70 D before LASIK surgery, with a final mean outcome of 0.20 ± 0.30 D of astigmatism.

Analysis of the predictability in myopic spherical equivalent refraction at 6 months in both groups (Fig 1) shows that 100% of the eyes were within ±1.00 D of intended correction. In hyperopia, this percentage is 87.5%, with 12.5% undercorrected (Fig 2).

Overall, the percent of eyes with uncorrected visual acuity of 20/20 or better was 18.3%, and 20/40 or better in 81.8%.

No patients lost two or more lines of Snellen visual acuity, and no adverse effects were observed.

**DISCUSSION**

We studied two groups of patients with moderate to high myopia and hyperopia with astigmatism that underwent two surgeries with a common final goal of emmetropia. Final mean spherical equivalent refraction ranged between -0.40 and +1.50 D.

These results would not be possible with only one
refractive surgical procedure because of residual astigmatism. Radial or arcuate keratotomy is generally not effective for more than 2.00 to 3.00 D of astigmatism, and predictability may not be optimal.

Photorefractive keratectomy is useful to correct some refractive errors, but the total range of correction excludes some cases.

Laser in situ keratomileusis has been shown to be effective for correction of myopia, hyperopia, and/or astigmatism, with eye tracking and customized laser ablation to reduce optical aberrations.7

Several authors have studied the refractive results of clear lens extraction with phacoemulsification and IOL implantation, followed by LASIK (Pershin KB, Pashinova NF. Fine tuning excimer laser correction after intraocular lens implantation and corneal transplantation. J Refract Surg 2000;16(suppl):S257-S260). The combined two-step surgery enables us to distribute the total refractive defect for each surgical procedure in order to adjust the final outcomes.

Another important aspect of the study are astigmatism results, the planned group having a higher amount (average 3.50 D). It is important to take into account the effect of the surgery in the evolution of this parameter; after lens surgery, it was reduced to 2.25 D, and after LASIK, it approached 0.40 D in this group. In the nonplanned group, there was not as much astigmatism to be corrected, and the final result approached 0.20 D

REFERENCES