Sequential Ablation Approach to the Correction of Mixed Astigmatism

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ABSTRACT

PURPOSE: To evaluate the safety, efficacy, and stability of LASIK, using positive cylinder and negative sphere nomograms in sequence (sequential ablation) to correct mixed astigmatism.

METHODS: This prospective study included 40 eyes of 20 patients with mixed astigmatism. Patients underwent bilateral sequential ablation LASIK using the Technolas 217 excimer laser (Bausch & Lomb Surgical, Rochester, NY). The main outcome measures, uncorrected visual acuity (UCVA) and best spectacle-corrected visual acuity (BSCVA), were evaluated 3 and 12 months after surgery.

RESULTS: Preoperative astigmatism ranged from +1.75 to +6.00 diopters (D) and negative sphere from −0.50 to −3.00 D. The postoperative refraction at 3 months remained unchanged at 1 year postoperative in all patients. A total of 32 (80%) eyes showed no significant residual astigmatism (<0.50 D); the remaining 8 (20%) eyes had 0.50 to 1.00 D of residual astigmatism. Residual negative sphere was present in 2 eyes of 2 patients with a planned monovision target. In the remaining 38 (95%) eyes, no significant residual negative sphere was present. Sixteen (40%) eyes had one line of improvement in BSCVA. No eye lost lines of visual acuity. The efficacy index shows that uncorrected vision after surgery is equal or better than corrected vision before surgery. Less corneal tissue is removed and fewer laser spots are required compared to other techniques for the correction of mixed astigmatism.

CONCLUSIONS: The sequential ablation approach to the correction of mixed astigmatism was efficacious, safe, and stable 1 year after surgery. [*J Refract Surg*. 2006;22:787-794.]

The correction of mixed astigmatism remains a challenge for refractive surgeons. Despite numerous available techniques, results are often incomplete and frequently require retreatment.

Among the available techniques is astigmatic keratotomy, in which transverse or arcuate relaxing incisions are made along the steepest corneal meridian. Although this technique offers good correction of mixed astigmatism, it has the disadvantages of poor predictability and potential under- or overcorrection, which makes its use less frequent.[1-3]

There are also a number of LASIK approaches for the correction of mixed astigmatism. A negative-cylinder nomogram approach can be used to perform a central ablation along the steepest corneal meridian,[4] which also induces some flattening in the flattest meridian.[2,5] This method, however, requires more tissue removal in cases of mixed and simple myopic astigmatism.[6] With a positive-cylinder nomogram approach, the excimer laser ablation steepens the flattest meridian with no significant effect on the steepest meridian because the ablation is not performed in the central cornea.[2,7] It has the advantage of preserving more tissue than the negative-cylinder nomogram approach.[6] Finally, the bitoric or cross-cylinder technique for the correction of mixed and simple myopic astigmatism, as described by Chayet et al,[2] flattens the steepest meridian with a central cylindrical ablation and steepens the flattest meridian with a paracentral ablation. Balancing negative and positive ablations, the bitoric approach has the advantages of correcting the same refractive defect with less tissue removal[2,6,8] and also improves the optics of the eye.[9]

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The sequential treatment of positive cylinder and negative sphere is another approach that can be used to correct mixed astigmatism. After an accurate refractive examination under cycloplegia, it is possible to manage the negative sphere properly and to determine the defect of mixed astigmatism considering positive cylinder and negative sphere. Furthermore, in presbyopic patients it is possible to leave some residual negative sphere in the non-dominant eye to obtain monovision. The technique presented here allows surgeons to decide whether to fully correct the myopic error or to correct it only partially, according to the patient's needs. The name of this technique derives from the use of positive cylinder and negative sphere in sequence.

In this study, we assessed the safety, efficacy, and stability of LASIK using this sequential ablation technique. We also compared this approach with other existing techniques in terms of the number of laser spots used, ablation profile, and postoperative visual acuity.

PATIENTS AND METHODS

Patient Selection and Preoperative Preparation

This prospective study included 40 eyes of 20 patients (9 men and 11 women) with preoperative mixed astigmatism ranging from +1.75 to +6.00 diopters (D) and negative sphere in the range of −0.50 to −3.00 D operated on at the Istituto Laser di Microchirurgia Oculare, Brescia, Italy between January 1 and June 30, 2004. Mean patient age was 40.2±14.6 years (range: 21 to 65 years).

All patients selected met the eligibility criteria: age >21 years, central cornea thickness >530 µm, regular astigmatism, stable refraction for 1 year, good general health, absence of ophthalmic disease, high motivation, realistic expectations, and informed consent with complete understanding. Exclusion criteria included: best spectacle-corrected visual acuity (BSCVA) <20/80, pupil diameter >6.0 mm under dim illumination, evidence of developing cataract, history of uveitis or posterior synechiae, corneal dystrophy, intraocular pressure (IOP) >20 mmHg, and presence of disc pathology.

Consecutive patients complying with eligibility and not meeting exclusion criteria comprised the sample studied. All patients were informed about the details and risks of LASIK procedures, and a written informed consent was discussed and obtained.

The preoperative examination included anterior segment examination at the slit-lamp, manifest refraction, cycloplegic refraction, IOP measurement, fundus examination, pupil diameter, uncorrected visual acuity (UCVA), BSCVA, corneal topography with the System 2000 (Eyesys Premier, Irvine, Calif), corneal tomography with the Orbscan II (Bausch & Lomb Surgical, Rochester, NY), and corneal pachymetry using the SP 2000 pachymeter (Tomey, Nagoya, Japan) (5 examinations from central to peripheral cornea). The amount of refractive error was based on the cycloplegic refraction.

The day before surgery, all patients instilled one drop of topical tobramycin and dexamethasone eye drops (TobraDex; Alcon, Ft Worth, Tex) three times a day in each eye as prophylaxis.

On the day of surgery, all patients were given topical anesthesia with three drops of proparacaine hydrochloride ophthalmic solution USP 0.5% (Bausch & Lomb) followed by three drops of tetracaine hydrochloride ophthalmic solution USP 0.5% (Bausch & Lomb) in each eye approximately 10 minutes before surgery. This was repeated a few seconds before surgery. Patients underwent simultaneous bilateral sequential ablation LASIK performed by a single surgeon (R.P.) within 1 month of enrollment.

Operative Procedure

The Gebauer Elektronik Lasitome microkeratome (Gebauer GmbH, Neuhausen/Enzkreis, Germany) was set for a 160-µm flap with a lateral-nasal hinge cut. The Technolas 217 excimer laser with the PlanoScan program (Bausch & Lomb) and a 2-mm flying spot was programmed to treat positive cylinder first and negative sphere next, so that two different nomograms were used for the same eye during the same surgical operation.

For the treatment of sphere and cylinder, the optical zone was 6 mm and the transition zone was 9.2 mm. The axis alignments were marked at the slit-lamp immediately before surgery, using a gentian violet pen (at 6 o'clock and 9 o'clock) at the limbus. The nomograms were based on subjective refraction considering the cycloplegic determination of the sphere ("cycloplegic adjusted subjective refraction") where the axis and the power of the cylinder are subjectively determined and the sphere is cycloplegically determined.

Antiseptic prophylaxis was performed just before surgery with one drop of povidone-iodine 5% solution on the conjunctiva. It was ensured that the temperature and humidity ranges in the operating room were in conformity with the instructions in the laser manual. A fluence test was performed, putting the laser in an optimum energy level. Eyelashes were removed from the surgical field with 3M adhesive drapes (3M, St Paul, Minn). A Slade speculum (Asico, Westmont, Ill) was used. The cornea was identified with a marker stained with gentian violet to achieve proper corneal flap repositioning. A suction ring was placed on the eye, centering the ring around the corneal limbus, and vacuum suction was applied. The patient's position on

TABLE 1

Refractive Data on 8 Eyes With Residual Astigmatism

	Before Sequential Ablation LASIK			After Sequential Ablation LASIK		
Eye/Sex/Age (y)	UCVA	Refraction	BSCVA	UCVA	Refraction	BSCVA
1/F/25	20/50	−1.0 +3.0 × 85°	20/25	20/25	−0.5 +1.0 × 90°	20/20
2/F/25	20/40	−1.0 +4.0 × 95°	20/20	20/25	−0.5 −0.7 × 165°	20/20
3/M/28	20/50	−0.7 +3.0 × 180°	20/25	20/25	−0.5 +1.0 × 100°	20/20
4/F/30	20/40	−1.5 +3.0 × 80°	20/30	20/30	−0.5 −0.7 × 180°	20/25
5/F/33	20/60	−2.0 +5.0 × 75°	20/30	20/30	−1.0 −0.7 × 70°	20/25
6/F/40	20/40	−1.0 +3.0 × 120°	20/25	20/25	−0.5 +0.7 × 110°	20/20
7/M/45	20/50	−1.5 +3.0 × 70°	20/25	20/25	−0.25 +1.0 × 80°	20/20
8/M/62	20/60	−2.5 +5.0 × 75°	20/30	20/30	−0.7 +1.0 × 70°	20/25

UCVA = uncorrected visual acuity, BSCVA = best spectacle-corrected visual acuity

the laser bed was checked and adjusted so that equal parts of sclera were visible above and below the superior and inferior limbal poles. Keratectomy was then performed, making a lateral-nasal hinge cut. A Merocel sponge (Medtronic ENT, Jacksonville, Fla) was used to soak up any limbal bleeding. The flap was lifted with a MacRae spatula (American Surgical Instruments Corp, Westmont, Ill), and with the patient aligned properly and the eye tracker on, laser ablation was begun.

During the treatment between one phase and the following one, the cyclotorsional adjustment of the eye was performed following the slit-lamp preoperative marking points (at 6 and 9 o'clock).

After correction of the positive cylinder, the flap was kept open, and the laser was prepared to execute the second nomogram within approximately 30 seconds. The flap was restored after hydration with 3 drops of balanced salt solution (BSS) on the stromal side. After irrigation, the correct position of the flap in relation to the previous marked line was verified. A striae test was performed to ensure that the flap was in the correct position. Finally, three drops of topical TobraDex were applied and the speculum and sterile drape were removed.

The intended correction was plano in 38 of 40 eyes (18/20 patients). Two eyes of 2 patients received a monovision correction, which consisted of positive cylinder correction followed by a partial resolution of the negative sphere in the non-dominant eye, leaving a planned residual sphere. The range of residual sphere was planned relative to the age of the presbyopic patient.

Postoperatively, all patients were instructed to instill TobraDex drops 4 times daily for 1 week. Artificial tears were recommended. Follow-up examinations were done at 1 day, 1 week, 1 month, 3 months, and 1 year postoperatively. Postoperative examinations consisted of UCVA, BSCVA, refraction, slit-lamp examination, corneal topography, and corneal tomography (Orbscan).

For data analysis, the preoperative mixed astigmatism in each eye was compared to the 3- and 12-month postoperative refractions to determine the percentage reduction in the mixed defect and the conservation or loss of visual acuity over time. Residual astigmatism was defined as any astigmatism $\geqslant$0.50 D. The efficacy ratio was calculated as postoperative UCVA/preoperative BSCVA. An efficacy ratio $>$1 indicates that uncorrected vision after surgery is better than corrected vision before surgery.

Additionally, to compare the various available laser techniques with this sequential ablation technique, a hypothetical case of mixed astigmatism with the following refraction was chosen: −1.00 +3.00 × 90°. Using the most recent software version (3.11) of the Technolas 217 excimer laser, a 6-mm optical zone, and 2-mm flying spot, a theoretical comparative analysis of the number of spots necessary and the ablation depth required for the correction of this hypothetical mixed astigmatism was done. Sequential ablation was compared to positive cylinder nomogram ablation, negative cylinder nomogram ablation, and cross-cylinder. The ablations were simulated on a fluence plate and the various profiles obtained were assessed.

RESULTS

Of the 20 patients, 15 had astigmatism from 1.00 to 4.00 D and spherical equivalent refraction from −0.50 to −2.00 D; the remaining 5 patients had astigmatism from 4.00 to 6.00 D and spherical equivalent refraction from −2.00 to −3.00 D.

TABLE 2

Cycloplegic Refractive Data on 40 Eyes Before and After Sequential LASIK for Mixed Astigmatism

	Right Eye				
Patient No./Sex/ Age (y)	Preoperative Refraction	Preoperative BSCVA	Postoperative Refraction	3 Months to 1 Year Postop UCVA	3 Months to 1 Year Postop BSCVA
1/F/21	−1.0 +2.0 × 90°	20/25	−0.25 −0.50 × 90°	20/20	20/20
2/M/22	−1.0 +2.0 × 90°	20/20	−0.25 +0.50 × 90°	20/20	20/20
3/F/25	−1.0 +3.0 × 90°	20/25	−0.50 +0.50 × 100°	20/20	20/20
4/F/25	−0.5 +4.0 × 85°	20/20	−0.25 +0.50 × 90°	20/20	20/20
5/M/28	−1.0 +3.0 × 170°	20/40	−0.50 +0.25 × 165°	20/25	20/25
6/F/30	−1.5 +3.0 × 80°	20/25	−0.25 +0.50 × 95°	20/20	20/20
7/F/30	−1.5 +3.0 × 80°	20/40	−0.50 −0.70 × 180°	20/30	20/25*
8/F/32	−2.0 +4.0 × 180°	20/20	−0.50 +0.50 × 175°	20/20	20/20
9/F/33	−3.0 +5.0 × 95°	20/40	−0.25 +0.50 × 100°	20/25	20/25
10/M/38	−2.0 +3.0 × 90°	20/25	−0.25 +0.50 × 90°	20/20	20/20
11/F/40	−2.0 +4.0 × 90°	20/25	−0.50 +0.25 × 95°	20/20	20/20
12/F/41	−2.0 +6.0 × 80°	20/40	−0.25 +0.50 × 85°	20/30	20/30
13/M/45	−1.7 +4.0 × 90°	20/20	−0.50 +0.50 × 95°	20/20	20/20
14/F/45	−1.0 +4.0 × 160°	20/20	−0.25 +0.50 × 165°	20/20	20/20
15/F/50	−3.0 +6.0 × 80°	20/40	−0.50 +0.50 × 85°	20/25	20/25
16/M/60	−2.0 +3.0 × 90°	20/25	−0.50 +0.50 × 95°	20/20	20/20
17/M/61	−1.0 +2.0 × 90°	20/20	−0.25 +0.25 × 90°	20/20	20/20
18/M/62	−2.0+5.5 × 90°	20/40	−0.50 +0.50 × 95°	20/40	20/40
19/M/64	−2.0 +3.0 × 85°	20/25	−0.25 +0.50 × 85°	20/25	20/25
20/M/65	−3.0 +6.0 × 80°	20/40	−0.50 +0.50 × 85°	20/30	20/30

BSCVA = best spectacle-corrected visual acuity
**Eight eyes with residual astigmatism.*
†Patients who received monovision.

Three months postoperatively, in 32 of 40 eyes (80% of patients), no residual astigmatism was detected (⩽0.50 D) (95% confidence interval [CI]: 64% to 91%); the remaining 8 (20%) eyes had residual astigmatism from 0.50 to 1.00 D. These eight eyes gained one line of BSCVA (Table 1).

Two patients had residual myopic spherical equivalent refraction ⩾−0.50 D postoperatively. Moreover, in addition to these two eyes (monovision), another non-monovision eye had residual myopic spherical equivalent refraction >−0.50 D (Table 1, eye 5, residual spherical equivalent refraction = 0.65 D).

No significant changes were noted between the examinations conducted at 3 months and 1 year. A summary of patients' refractive data before and after sequential ablation LASIK is shown in Table 2.

No loss of lines of visual acuity was observed at 3 months and 1 year, the correction gained with surgery was maintained in all 40 eyes. Figure 1 shows a comparison between preoperative BSCVA and postoperative UCVA. The mean efficacy ratio (postoperative UCVA/preoperative BSCVA) was ⩾1 in all eyes.

In addition, the left eye of a 65-year-old patient (patient 20) could see only 20/25 preoperatively with best correction and 20/25 without correction after surgery, despite his programmed residual −1.00 D myopic monovision.

There were no lamellar cut-related complications, decentered ablations, epithelial ingrowth, or other intraoperative complications. None of the eyes needed any enhancement procedures.

In comparing the theoretical corrections performed with each LASIK method, it was observed that correction with the sequential ablation technique required a maximum paracentral corneal ablation of 56 µm

Left Eye				
Preoperative Refraction	Preoperative BSCVA	Postoperative Refraction	3 Months to 1 Year Postop UCVA	3 Months to 1 Year Postop BSCVA
−1.0 −2.0 × 90°	20/20	−0.25 +0.25 × 100°	20/20	20/20
−1.0 +3.0 × 90°	20/20	−0.25 +0.50 × 90°	20/20	20/20
−1.0 +3.0 × 85°	20/25	−0.50 +1.00 × 90°	20/25	20/20*
−1.0 +4.0 × 95°	20/25	−0.50 −0.70 × 165°	20/25	20/20*
−0.7 +3.0 × 180°	20/25	−0.50 +1.00 × 100°	20/25	20/20*
−1.0 +3.0 × 95°	20/25	−0.50 +0.50 × 95°	20/20	20/20
−2.0 +3.0 × 100°	20/40	−0.25 +0.50 × 100°	20/30	20/30
−1.0 +3.0 × 170°	20/25	−0.50 +0.25 × 165°	20/25	20/25
−2.0 +5.0 × 75°	20/40	−1.00 +0.70 × 70°	20/30	20/25*
−1.0 +2.0 × 100°	20/20	−0.25 +0.25 × 100°	20/20	20/20
−1.0 +3.0 × 120°	20/25	−0.50 +0.70 110°	20/25	20/20*
−2.0 +5.0 × 70°	20/40	−1.00 sph	20/25†	20/20
−1.5 +3.0 × 70°	20/25	−0.25 +1.00 × 80°	20/25	20/20*
−2.0 +4.0 × 170°	20/25	−0.50 +0.50 × 170°	20/25	20/25
−2.0 +5.0 × 70°	20/40	−0.25 +0.50 × 75°	20/25	20/25
−1.0 +3.0 × 90°	20/20	−0.25 +0.25 × 90°	20/20	20/20
−0.5 +1.7 × 90°	20/20	−0.25 +0.25 × 90°	20/20	20/20
−2.5 +5.0 × 75°	20/30	−0.70 +1.00 × 70°	20/30	20/25*
−1.0 +3.5 × 95°	20/25	−0.25 +0.50 90°	20/25	20/25
−2.0 +5.0 × 100°	20/25	−1.00 +0.25 × 90°	20/25†	20/20

and a central corneal ablation of 18 µm, with a total of 1377 spots; the positive cylinder nomogram ablation technique required a 69-µm paracentral ablation, 34-µm central ablation, and 1761 spots; the negative cylinder approach required a 136-µm paracentral ablation, 101-µm central ablation, and 5559 spots; and the bitoric technique required a 55-µm paracentral ablation, 19-µm central ablation, and 1411 spots. The pictures of the different ablation profiles obtained on the fluence plate are shown in Figures 2 through 5. The spherocylindrical refraction of this hypothetical case was −1.00 +3.00 × 90°. The ablated material is a fluence plate (Bausch & Lomb) formed by an upper thin metal layer and a lower plastic layer. All pictures were done on the same scale. In the first pattern obtained, simulating the positive cylinder nomogram ablation (see Fig 2), a consistent tissue ablation can be noted even with the naked eye considering the total surface area of laser action (area of white zone plus that of red zone). Figure 3 shows the ablation profile obtained simulating the negative cylinder approach, which requires an even larger surface area of tissue ablation. The third pattern (see Fig 4) is that of the bitoric ablation and the last (see Fig 5) is the profile obtained with the sequential ablation technique. The similarity between these last two ablation profiles can be noted, although the former is shorter and wider, whereas the latter is longer and narrower.

DISCUSSION

Mixed astigmatism can be surgically managed using astigmatic keratotomy, LASIK, or a combination of the two techniques.[8] Laser in situ keratomileusis techniques for correcting mixed astigmatism include negative cylinder nomogram, positive cylinder nomogram, bitoric,

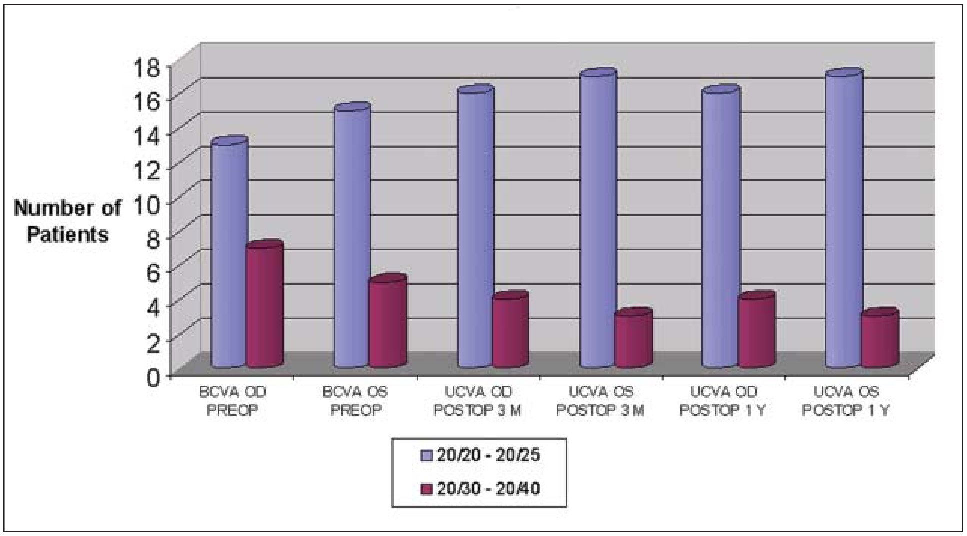

Figure 1. Comparison between preoperative BSCVA and postoperative UCVA in 40 eyes (20 patients) before and after sequential ablation LASIK for the correction of mixed astigmatism.

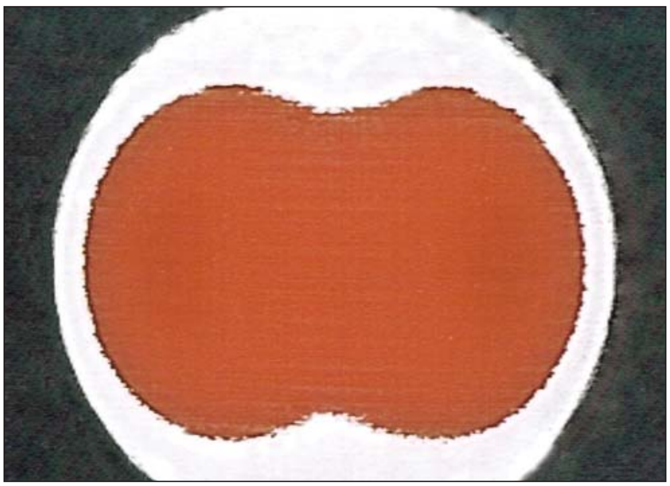

Figure 2. Positive cylinder excimer ablation profile. A consistent tissue ablation diameter can be noted even with the naked eye. Maximum ablation was 69 μm, with a central corneal ablation of 34 μm, and 1761 laser spots were made.

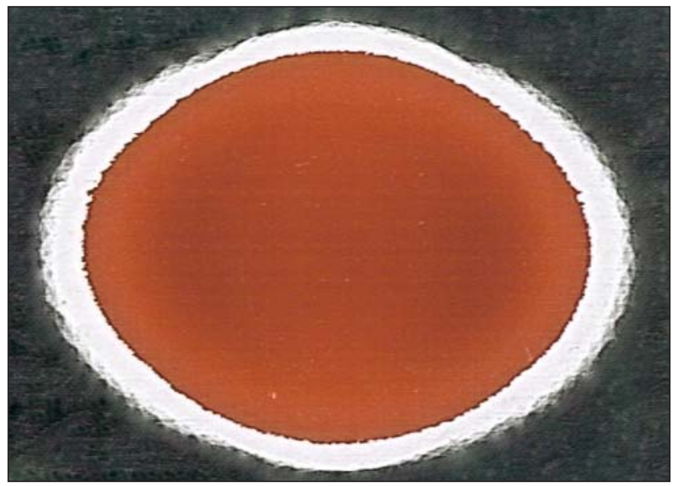

Figure 3. Negative cylinder ablation pattern. This approach requires even more tissue ablation. Maximum ablation was 136 μm, with a central corneal ablation of 101 μm, and 5559 laser spots were made.

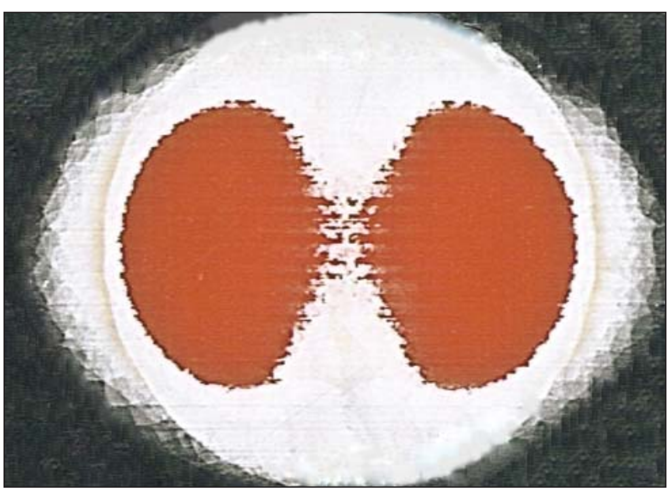

Figure 4. Cross-cylinder (bitoric) LASIK ablation profile. A smaller ablation can be noted in this profile. Maximum ablation was 55 μm, with a central ablation of 19 μm, and 1411 laser spots were made.

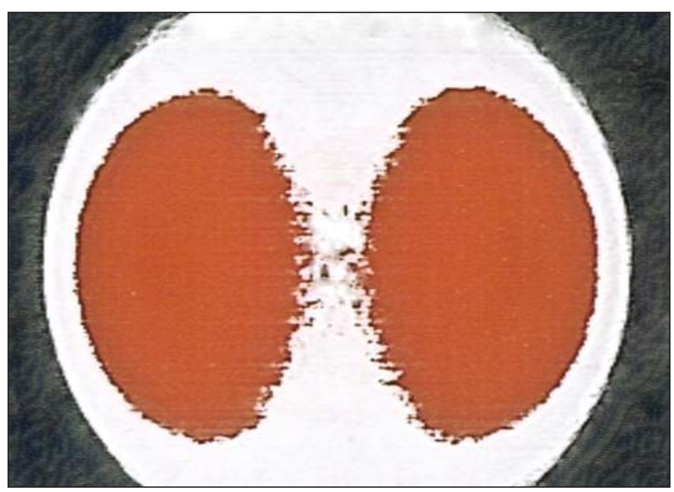

Figure 5. Sequential ablation LASIK profile. This pattern is similar to that obtained with the bitoric approach, however, the former is shorter and wider compared to the latter. Maximum corneal ablation was 56 μm, central corneal ablation was 18 μm, and 1377 laser spots were made.

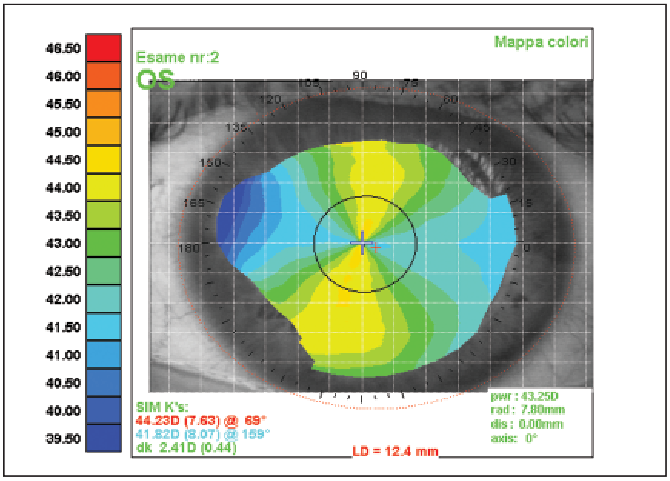

Figure 6. Preoperative corneal map. This patient presented with 2.40 D of cylinder at 69° and UCVA of 20/50 in the left eye, with a refraction of −1.00 +2.25 × 70°.

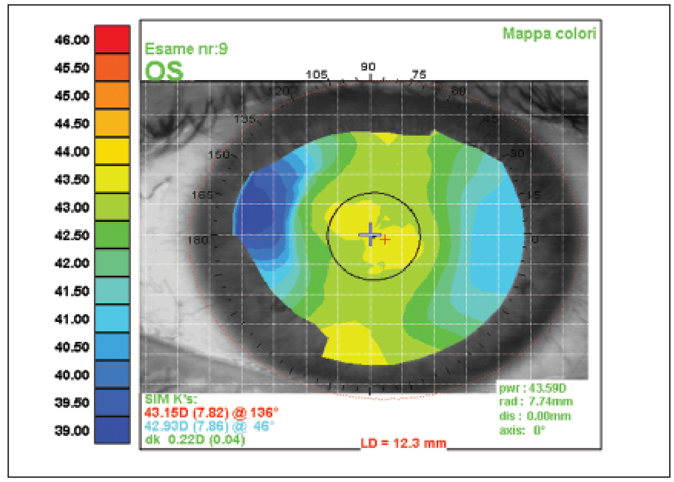

Figure 7. Postoperative corneal map. Correction done with sequential ablation LASIK can be noted.

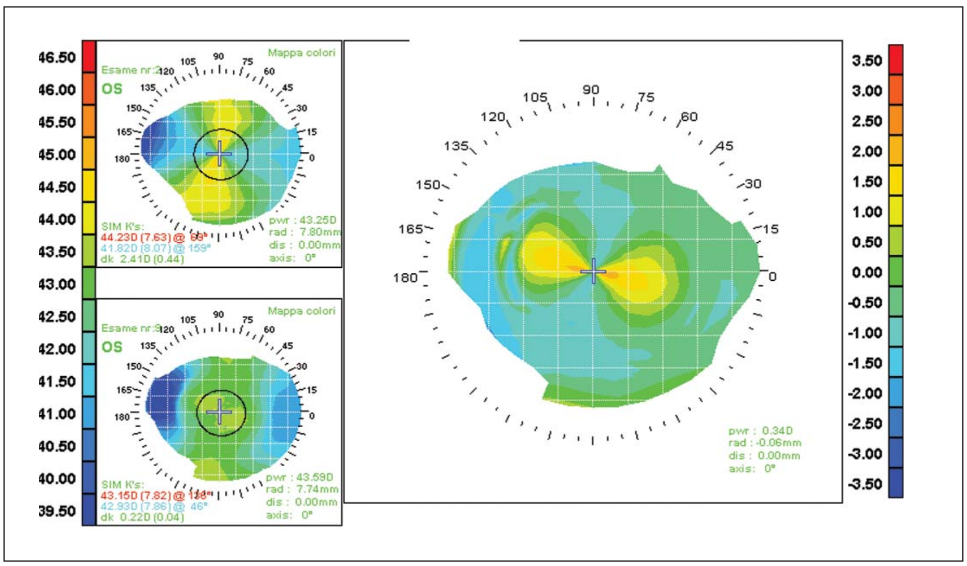

Figure 8. Difference corneal map of figures 6 and 7 shows the overall effect of treatment.

and the sequential ablation technique described here, which is based on the principle that a better resolution of the mixed astigmatism can be obtained by using two separate and sequential nomograms. The first step is the correction of the positive cylinder. The full astigmatism is corrected, working on the flat axis and obtaining a spherical cornea and a purely myopic eye. Next, the negative sphere is sequentially treated to correct the remaining myopia using the same optical zone (6 mm).

Based on the comparison of ablation patterns for these various methods, it can be concluded that the best two approaches to correct this hypothetical situation were the sequential ablation and bitoric techniques because they required fewer spots and therefore, a shorter ablation time, and because less tissue was removed compared to the other approaches.

The bitoric method required more spots (1411) than the sequential ablation method (1377). In terms of the amount of tissue ablation, it can be observed that these two techniques are overlapping and substantially the same. However, it is important to consider the clinical outcomes of the two approaches. In the present study, there were no retreatments. For the bitoric approach a retreatment rate of approximately 25% has been reported.[8,10] It remains to be determined whether this is due to the fact that in the sequential ablation technique there is complete correction of both positive cylinder and negative sphere as compared to the bitoric approach where there is no particular treatment of sphere.[8]

In the present study, 8 (20%) eyes (95% CI: 9%-36%) had residual astigmatism ranging from 0.50 to 1.00 D. We decided that no retreatments were necessary in these eyes because the amount of residual defect was small, bilateral visual acuity was satisfactory (1 line gain in UCVA), and these conditions remained stable at 1 year postoperative.

Figures 6 to 8 are pre- and postoperative corneal maps of the left eye of a 34-year-old man with mixed astigmatism treated with the sequential ablation technique in the present study. Figure 6 shows the patient's preoperative map with 2.40 D of cylinder at 69°. The patient's UCVA was 20/50 in the left eye, correctible to 20/20 with a refraction of $-1.00 +2.25 \times 70°$. Positive cylinder was treated first at the 6-mm optical zone, and sequentially the negative sphere was fully corrected. The surgical outcome is shown in the postoperative map (see Fig 7). Postoperative UCVA was 20/20+ (ie, equal to preoperative BSCVA). In the difference map shown in Figure 8, the overall effect of treatment can be appreciated.

In the present study, no eye showed any loss of lines of BSCVA and 16 (40%) eyes showed a gain of 1 line in BSCVA, whereas in the remaining 24 (60%) eyes, the visual acuity originally achieved with spectacles was attained after surgery. The efficacy ratio showed uncorrected vision after surgery was better than corrected vision before surgery. These results remained stable at 1 year postoperative.

The sequential ablation method allows for partial adjustment of the negative sphere in the non-dominant eye for monovision correction. As stated previously, the amount of residual sphere remaining is decided on the basis of the patient's age and needs.

Because the study was based on individual results and the large majority of results showed no postoperative cylinder (very few eyes reported a postoperative measurable cylinder), we believe vector analysis should not have a statistical impact.

The aberrometric analysis of this procedure was not performed in the study because the procedure was new—our purpose was to present a "basic" and "traditional" way to analyze visual acuity and topographic changes to understand the mechanism of function of this procedure.

The results of this study indicate that the sequential ablation technique for the correction of mixed astigmatism is efficacious, safe, and stable 1 year after surgery. Fewer laser spots were needed to correct the defect, less corneal tissue was removed, no loss in BSCVA was registered, and monovision could be attained if desired. Longer follow-up with more eyes is needed to further assess this method.

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