

## Ocular Deviation after Unilateral Laser *in situ* Keratomileusis

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### Abstract

Laser keratomileusis and excimer laser photorefractive keratectomy *in situ* are widely used therapies for treating myopia. The corrections of refractive error by glasses or contact lens result in a relatively equal refractive correction on both eyes. However, refractive surgery on a single eye can cause a focus disparity between both eyes and may result in the impairment of fusion leading to strabismus. This article aims to report a case where diplopia and esotropia occurred 1 month after laser keratomileusis (LASIK) *in situ* for the correction of myopia.

Key Words: Esotropia, diplopia, fusion, laser *in situ* keratomileusis (LASIK)

### INTRODUCTION

Laser keratomileusis (LASIK) *in situ*, a recently developed technique for treating moderate to high myopia, involves the lifting a corneal flap with a microkeratome then ablating the stromal bed with an excimer laser to achieve the required refractive change. Compared to photorefractive keratectomy (PRK), LASIK offers patients less postoperative pain and faster visual recovery. LASIK has been determined to be more effective and create less corneal haze than PRK in higher myopia.<sup>1-3</sup>

This article aims to report a case where diplopia and esotropia occurred 1 month after LASIK for myopic correction, and disappeared after LASIK was performed on the opposite eye.

### CASE REPORT

A twenty-nine year-old myopic woman was presented for a pre-surgical evaluation for laser keratomileusis *in situ*. She was unable to wear contact lenses due to severe complications but did not wish to wear glasses. The uncorrected visual acuity was 10/400 in

both eyes when tested with Snellen E-chart. The best corrected vision was 20/20 in each eye with a correction of -7.00 D sph -1.00 D cyl Ax 180° OD and -7.25 D sph -1.00 D cyl Ax 10° OS. The cycloplegic refraction was -6.75 D sph -1.25 D cyl Ax 180° OD and -7.00 D sph -1.25 D cyl Ax 180° OS. There was no specific finding under the fundus examination in both eyes. The patient had no history of ocular problems, i.e., strabismus, head tilt, diplopia, or previous eye surgery. She had a normal comprehensive eye examination, including normal motility. However, she complained that the left eye deviated instantaneously to the nasal side, one to two times.

The patient underwent LASIK on her right eye for the correction of myopia. A Twenty/Twenty Argon Fluoride Excimer laser system (VISX 20/20) with a wavelength of 193 nm and a 6 mm ablation zone was used as the ultraviolet radiation source. The fluence was set at 160 mJ/cm with a repetition rate of 5 Hz. The post-operative course was uneventful and the visual acuity was 20/20 in the right eye by Snellen E-chart 7 days after surgery.

1 month after surgery, the patient complained of diplopia. Visual acuity was 20/20 in the right eye and the postoperative refraction at 1 month was +0.75 D sph +0.25 D cyl Ax 90°. Cover testing elicited a large angle esodeviation in the left eye. A prism cover test revealed a 33△ left esotropia at both near and distance vision. There was a 30-prism diopter left esotropia and a 4 prism diopter right hypertropia at both near and distance vision, despite a contact lens

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Fig. 1. (A) The left eye is esodeviated one month after laser keratomileusis in situ. (B) The eyes are straightened on the primary position with the LASIK procedure in the left eye, one month after LASIK procedure in right eye.

correction to the emmetropia in the fellow eye (Fig. 1A).

Sensory testing (Worth 4-dot test) indicated diplopia at both near and distance vision without correction but showed suppression in the right eye after the left eye was corrected with a contact lens. At the Titmus stereo test, the threshold was 800 seconds of arc.

4 days after the diplopia and esotropia occurred, the patient underwent LASIK on her left eye. Four days later, sensory testing indicated diplopia and fusion at distance and near vision, respectively. However, the disappeared 1 week after surgery at both distance and near vision.

Under post-operative examination at 1 month after surgery on the left eye and 2 month on the right eye, the refractive error was +0.25 D sph OD, -0.25 D sph OS and the visual acuity was 20/20 OD, 20/25 OS by Snellen E-chart. The eyes were straight on the primary position. A prism cover test showed that an 8 prism diopter esophoria at near vision, but no diplopia at either near and distance vision (Fig. 1B).

## DISCUSSION

There are two distinguishing forms of acute comitant strabismus: (1) that occurring after artificial interruption of binocular vision and (2) that occurring without any obvious exogenous cause. The most common form of acute strabismus after artificial interruption of fusion in clinical practice by far, is that which occurs after a temporary occlusion of one eye in patients with no previous history of binocular vision disturbance or in the course of treatment of amblyopia those without strabismus (anisometropic). When the patch is removed, the occluded eye will be in an esotropic position in either children or adults with large-angle exophoria or exotropia.

This disturbing event has been reported after a perforating corneal injury, excision of a chalazion, or swelling of lids, when one eye has been bandaged for several days.<sup>4</sup> Symmetric sensory input to both retinas is required for the fusional mechanism to work properly. In previous studies, fusion has been affected by many factors including brightness, color disparity, optically induced glare and halos, and refractive error changes.<sup>5,6</sup> Any refractive surgical technique can affect any or all of these factors. Decompensated heterophorias have been reported after cataract surgery and radical keratotomy in addition to PRK.<sup>7,9</sup>

In this case, the tendency for deviation was probably secondary to the breakdown of fusion after LASIK surgery. The case of ocular deviation following unilateral LASIK surgery was reported in Korea for the first time.

The disparity of sensory input related to refractive error changes, that is, the difference of clearance and size of image on retinas, seems likely to induce the interruption of fusion after surgery.

There are many studies that compare safety and efficacy between simultaneous and sequential bilateral LASIK surgery. In the case of sequential bilateral LASIK, a surgeon can observe the change in refractive error in the previously operated eye in the interval, thereby reducing the error in the fellow eye. For that reason, many surgeons prefer a sequential treatment. However, some studies have reported that the outcomes and complications of performing bilateral simultaneous LASIK surgery were not significantly different from those of sequential treatments. An, unexplained exception is the more frequent epithelial ingrowth in the simultaneous group.<sup>10</sup>

Any refractive surgery on a single eye can cause a disparity in focus between both eyes and may result in the impairment of fusion leading to strabismus. Because of this, it is important that a motility exam and a cover test to assess the fusional status and presence of significant phorias be performed on all candidates for refractive surgery. Performing simultaneous or sequential bilateral LASIK surgery within a shorter period may prevent the decompensation of heterophorias. If ocular deviation occurred after unilateral LASIK, prompt treatment to restore fusional function should be performed as soon as possible.

## REFERENCES

1. Brint SF, Osterick DM, Fisher C, Slade SG, Maloney RK, Ebstein R, et al. Six-month results of the multicenter phase I study of excimer laser myopic keratomileusis. *J Cataract Refract Surg* 1994;20:610-5.
2. Pallikaris IG, Siganos DS. Excimer laser *in situ* keratomileusis and photorefractive keratectomy for correction of high myopia. *Refract Corneal Surg* 1994;10:498-510.
3. Davidorf JM, Zaldivar R, Oscherow S. Results and complications of laser *in situ* keratomileusis by experienced surgeons. *J Refract Surg* 1998;14:114-22.
4. Von Noorden GK. Binocular vision and ocular motility: Esodeviation. 5th ed. St.Louis: Mosby Company; 1995. p. 324-5.
5. Keenejy AH, Shrader EC. Kinetic visual disturbances with contact lenses. *Surv Ophthalmol* 1983;28:112-6.
6. Von Noorden GK. Binocular vision and ocular motility: Binocular Vision and Space Perception 5th ed. St.Louis: Mosby Company; 1995. p.12-3.
7. Naresh M, Eric DD, Paul LO, Stephen EK, David HH. Ocular deviation following excimer laser photorefractive keratectomy. *J Cataract Refract Surg* 1996;22:504-5.
8. Hamed LM, Helveston EM, Ellis PD. Persistent biocular diplopia after cataract surgery. *Am J Ophthalmol* 1987; 103:741-4.
9. Marmer RH. Ocular deviation induced by radial keratotomy. *Ann Ophthalmol* 1987;19:451-2.
10. Waring GO 3rd, Carr JD, Stulting RD, Thompson KP. Prospective, randomized comparison of simultaneous and sequential bilateral laser *in situ* keratomileusis for the correction of myopia. *Trans Am Ophthalmol Soc* 1997;95: 271-84.