

Original Article**Oculocardiac reflex in laser in situ keratomileusis***Alireza Ashtari* , Ali Akbar Mortazavi****Abstract**

BACKGROUND: This study was conducted to evaluate variations in heart rate and to determine the occurrence of oculocardiac reflex (OCR) during laser in situ keratomileusis (LASIK).

METHODS: This descriptive, prospective study was designed to observe the effect of suction ring and ablation stages during LASIK procedure on the heart rate. The ECG was taken before and during LASIK operation on the first eye in 61 patients. These patients were selected randomly among cases that presented to Al-Zahra Hospital, Isfahan, Iran for LASIK surgery in summer 2001. All patients were healthy without history of cardiovascular disease and no systemic medication. The ECG prior to the procedure was considered as baseline. Decrease in the heart rate of 10% or more of baseline was considered as oculocardiac reflex.

RESULTS: In 12 patients (20%) the heart rate decreased more than 10% during the suction ring stage. In 19 patients (31%) the heart rate increased more than 20% of baseline. In 15 patients (25%) the heart rate increased 10%-20% more than baseline during the preparation and ablation stages. In the remaining 15 patients (25%) the heart rate did not change during the procedure.

CONCLUSIONS: Results of this study confirm that oculocardiac reflex may occur during the LASIK procedure especially in the suction ring stage. Because the oculocardiac reflex may cause heart rate changes during LASIK, the patients should be closely monitored during the procedure.

KEY WORDS: Laser in situ keratomileusis, oculocardiac reflex, suction ring.

JRMS 2006; 11(5): 309-312

Laser in situ keratomileusis (LASIK) has become more popular because of high patient acceptance associated with low postoperative discomfort, rapid return of vision and reduced need for long term medications¹. LASIK is one of the most popular and effective surgical techniques used for correcting refractory errors^{2,3}. In the LASIK procedure, a flap 130-180 μm in depth and 9.0 mm or more in diameter is removed from the cornea using microkeratome. Depending on the patient's refraction degree, anterior stroma is ablated by laser and corneal flap is repositioned after irrigation of the interface¹. LASIK complications include corneal infection and edema, epithelial ingrowth, incomplete flap or

free cap, sands of Sahara syndrome⁴, corneal perforation (rarely)⁵, overcorrection and undercorrection⁶ and oculocardiac reflex (OCR)⁷. LASIK has many benefits compared with PRK and RK, including low pain after operation, decreased damage of epithelium and bowman layers, and significantly decreased corticosteroid administration⁸.

The oculocardiac reflex is created by tension on the globe, extraocular muscle tension, orbital hematoma, orbital trauma and even ophthalmic pain. OCR is a trigeminovagal reflex that presents with nodal rhythm bradycardia, ectopic pulse, ventricular fibrillation and asystole the afferent impulse begins at short and long ciliary nerves and then goes to the ciliary

* Assistant Professor, Department of Ophthalmology, Isfahan University of Medical Sciences, Isfahan, Iran.

Correspondence to: Dr Ali Akbar Mortazavi, Assistant Professor, Department of Ophthalmology, Feiz hospital, Isfahan University of Medical Sciences, Isfahan, Iran. e-mail: mortazavi@med.mui.ac.ir

ganglion, the gasserian ganglion (a division of the trigeminal nerve) and then goes to the main sensorial trigeminal nucleus and finally to sensory histaminic trigeminal nucleus in the floor of the left ventricle. The efferent impulse begins from muscles of vagal cardiac depressor nerve that have negative inotropic effects.

The OCR mostly occurs in strabismus surgery but occasionally in retinal operation and retrobulbar anesthesia. This complication is a slowing of the heart rate caused by traction on the extraocular muscles. In its most severe form, the reflex can produce asystole.

The surgeon should be aware of the possibility of inducing the OCR, when manipulating a muscle and should be prepared to release tension if the heart rate drops excessively⁹. Intravenous atropine injection, light extraocular muscle manipulation, and suitable ventilation for producing normocarbia can decrease the incidence and severity of OCR. Although bradycardia is the most common form of OCR, other abnormality patterns such as nodal rhythm, junctional and atrial ectopic and even ventricular arrhythmia may also occur.

Several studies have reported the occurrence of OCR during LASIK^{7,10,11}. Preparedness to manage this complication is of importance; hence we surveyed its frequency and severity in our patients.

Methods

This is a descriptive study. The samples were selected randomly from among patients presenting for LASIK to Al-Zahra Hospital, Laser clinic. The number of patients needed for the study was determined at 61 according to formula ($N = [z^2 p(1-p)] / d^2$). Patients were evaluated for cardiovascular disease and drug administration. Patient examination by slit lamp, topography, pachymetry, and cycloplegic refractometry were done and the results were recorded. All of the patients were healthy, had no cardiac diseases, and received no medications before, or during the operation. They were in good general condition and were candidates for LASIK. The operation was done by Nidek Ec 5000 excimer laser and Hansa-

tome microkeratome. An ECG (DII) was recorded for all patients before operation as baseline ECG. After entering the operation room in supine position and adjustment of light microscope, another ECG (DII) was recorded as preparation ECG. During the suction ring stage and ablation in first eye of each patient, another ECG was recorded and heart rate was calculated by intervals between QRS waves. The data was recorded in special sheets according to age, sex and stage of operation. The amount of increase or decrease of heart rate based on baseline ECG was calculated. The OCR was defined as a decrease of 10% or more from the basal heart rate.

Results

Sixty-one patients undergoing LASIK surgery were evaluated for OCR. The age of patients was 20-45 years. In 14 patients (23) the heart rate dropped more than 10%, indicating a positive OCR. OCR in preparation stage was zero. Twelve patients in the suction ring stage (19.7%) and two (3.3%) in the ablation stage showed positive OCR.

The highest frequency was in the 20-24-year group (41.7%) and the lowest was in the 35-39-years and 40-45-year groups (0%). The frequency in the 25-29-year and 30-34-year groups was 33.3% and 25%, respectively (table 1). The frequency of OCR was 58.3% in male patients and 41.7% in female patients. Changes in heart rate in preparation stage, and suction ring and ablation stages are described as a percentage of base line. Heart rate decrease according to baseline was shown as a negative number and heart rate increase was shown as a positive number. Heart rate changes are presented in table 2. In 19 patients (31%) the heart rate increased over 20% of baseline, which was mostly in the preparation stage. In 15 patients (25%), increase of heart rate was in range of 10%-20% of baseline and the heart rate did not change in 15 patients (25%).

Discussion

Today, among different techniques and operations used for refractive error surgery, LASIK

Table 1. Frequency of positive OCR according to age groups

Age groups years	Frequency	Number	Percent
20- 24		5	41.7
25- 29		4	33.3
30 – 34		3	25
35- 39		0	0
40- 45		0	0
Total		12	100

Table 2. Frequency of heart rate changes in different stages of LASIK

Heart rate changes (relation to baseline)	Preparation		Suction ring stage		During ablation	
	No	%	No	%	No	%
>20% decrease	0	0	3	4.9	0	0
10- 20 % decrease	0	0	9	14.7	2	3.3
range of <10% decrease or increase	30	49.2	29	47.6	32	52.4
10- 20% increase	18	19.5	11	18.1	15	24.6
>20% increase	13	21.3	9	14.7	12	19.7
Total	61	100	61	100	61	100

is a popular and acceptable procedure. In spite of the many advantages of LASIK, some complications may occur. The OCR is one of these complications. The first investigation on OCR in LASIK was performed in 1998 by Paciuc et al. In their study, ECG was recorded before LASIK operation, during blepharostat insertion, suction ring stage and during laser ablation in the first eye of 20 patients. According to their study, 20% of the patients had decrease of heart rate in suction ring stage; this decrease was 30% of baseline in 50% of the patients. In 20% of the patients, heart rate increased by 20% of baseline and in the remaining 12 patients (60%), heart rate did not change⁷. In another study in 1999 by Paciuc et al., the findings suggested that the OCR occurs more frequently in sedated patients having LASIK than in non-sedated patients¹⁰. In one case reported by Baykara et al., severe bradycardia of 40 beats/min developed during vacuum application, and the procedure was terminated¹¹.

In our study, OCR was seen more in the

low-age group (20-24 year) (41.7%). This may be mostly due to nervous reflexes in lower ages. Also, a higher frequency of OCR was seen in the suction ring stage which might be due to sudden increase in intraocular pressure or orbital stimulation happening in this stage. The findings suggest that the oculocardiac reflex occurs more in men, and that bradycardia due to OCR probably subsides because women have more stress and release higher amounts of catecholamines. In this study, increase of heart rate was seen in 31.7% of the patients, which is more than previous studies. This tachycardia may be a result of stress, low knowledge of operation and cultural issues. Studies confirm that OCR may occur during the LASIK procedure, especially in the suction ring stage and that the patients should be closely monitored during the procedure for prevention of severe heart rate changes and possible problems. Future studies are needed to evaluate OCR and its relation to eye operation, age, sex, and other factors.

References

1. Thomas J, Thomas A, Gilbert M. External disease and cornea. Laser procedures for refractive correction. San Francisco: American Academy of Ophthalmology; 2003. p. 487-492.
2. Zaldivar R, Rocha G. **The current status of phakic intraocular lenses.** *Int Ophthalmol Clin* 1996; 36(4):107-111.
3. Duffey RJ. **Central islands and decentered ablations after LASIK.** *Int Ophthalmol Clin* 2000; 40(3):93-101.
4. Buratto L, Bring S. Custom Lasik: Surgical Techniques and Complications: Photo CD. 2nd ed. Thorofare, NJ: Slack Incorporated; 2000.
5. Thomas J, Gregory L, Louis B. Photoablation in refractive surgery. Laser procedures for refractive correction. San Francisco: American Academy of Ophthalmology; 2005. p. 120-135.
6. Rich LF. Complication of lasik. In: Elander RE, Rich LF, Robin JB, editors. Refractive Surgery. Philadelphia: WB Saunders; 1997. p. 174-221.
7. Paciu M, Mendieta G, Naranjo R. **Oculocardiac reflex during laser in situ keratomileusis.** *J Cataract Refract Surg* 1998; 24(10):1317-1319.
8. Barraquer JI. **The history and evolution of keratomileusis.** *Int Ophthalmol Clin* 1996; 36(4):1-7.
9. Thomas J, Thomas A, Gilbert M. Surgery of extraocular muscles in BCSC section 6. In: Wright KW, Spiegel PH, Hengst TC, Gilbert S, Cogswell F, editors. Pediatric Ophthalmology and Strabismus; 2003.
10. Paciu M, Mendieta G, Naranjo R, Angel E, Reyes E. **Oculocardiac reflex in sedated patients having laser in situ keratomileusis.** *J Cataract Refract Surg* 1999; 25(10):1341-1343.
11. Baykara M, Dogru M, Ozmen AT, Ozcetin H. **Oculocardiac reflex in a nonsedated laser in situ keratomileusis patient.** *J Cataract Refract Surg* 2002; 28(9):1698-1699.