

# Visual Quality of Q-value-guided LASIK in the Treatment of High Myopia

Hua Zheng\*, Liangwen Song

Zhongshan Ophthalmic Center, Guangzhou 510060, China

## Abstract

**Purpose:** To compare visual performance and patient satisfaction following Q-value-guided customized laser-assisted in situ keratomileusis (LASIK) and standard LASIK in the treatment of high myopia.

**Methods:** A total of 116 patients with high myopia ( $-6.00$  to  $-9.50$ D; astigmatism from  $-0.00$  to  $-2.00$ D) were treated using Z-217 excimer laser (Bausch & Lomb). Sixty-six patients (132 eyes) receiving Q-value-guided customized LASIK were assigned into the experimental group, and 50 cases (100 eyes) receiving standard LASIK were used as normal controls. All subjects were followed up for  $> 6$  months to monitor for night vision problems measure postoperative quality of life.

**Results:** In the experimental group, night vision acuity decreased in 3 cases (4.5%), and glare was reported in 13 patients (19%) during the 6-month follow up period. In the control group, night vision problems were noted in 9 cases (18%), and glare occurred in 21 patients (42%). These differences between the two groups were statistically significant ( $P < 0.05$ ). According to the postoperative questionnaire, satisfaction with visual performance and quality of life was reported in 73% of the experimental group, and 52% of the control group ( $P < 0.05$ ).

**Conclusion:** Patients with high myopia surgically treated by Q-value-guided LASIK had better night-time visual performance and a higher degree of satisfaction compared with subjects receiving standard LASIK. (*Eye Science* 2011;26:208–210)

**Keywords:** Q-value; LASIK; high myopia; visual quality

Laser-assisted in situ keratomileusis (LASIK), which is applied across the world owing to its safety and efficacy, currently serves as the major treatment of myopia. In recent years, with the ad-

vancement of clinical surgery and the development of surgical instruments, the level of treatment has been elevated accordingly. Although many post-operative patients have improved vision acuity, some patients with acute myopia complain of decreased vision acuity, glare, and other symptoms that can affect post-operative vision to varying extents and consequently fails to meet the patients' expectations of operations. Q-value-guided LASIK is regarded as a relatively novel surgical option, which is able to improve post-operative visual quality to a certain extent. We retrospectively analyzed the clinical information pertaining to Q-LASIK by using a Technolas 217 Excimer laser in our department.

## Materials and methods

### Study subjects

The myopia patients receiving Excimer laser therapy in our department, with complete follow-up, between January and August 2010 were retrospectively analyzed in this study. In the experimental group, the patients were subjected to Q-value-guided LASIK, and those in the control group received standardized LASIK.

**Experimental group:** a total of 66 myopia patients (132 eyes) received Q-LASIK surgery (29 males and 37 females, aged from 18 to 43 years); the pre-operative myopia ranged from  $-6.00$ D to  $-9.50$ D, and up to 2.25D of astigmatism. **Control group:** a total of 50 subjects (100 eyes) received standardized LASIK surgery (27 males and 23 females, aged from 18 to 39 years); the pre-operative myopia ranged from  $-6.00$ D to  $-9.00$ D, and astigmatism up to  $-2.00$ D. As shown in Table 1, below, no significant difference was noted when comparing the two groups with regard to age, sex and mean spherical equivalent (MSE) ( $P > 0.05$ ).

DOI: 10.3969/g.issn.1000-4432.2011.04.005

**Corresponding author:** Hua Zheng, Excimer Laser Room, Zhongshan Ophthalmic Center, 54 Xianlie Road. E-mail: zhenghua666@126.com

**Table 1** Comparison on MSE between two groups preoperatively

Group	Number of cases	MSE
Experimental group	66	7.04±0.87
Control group	50	7.01±0.80
<i>P</i> value		0.83

**Ocular examinations and follow-up**

Multiple ocular examinations, including distant vision, near vision, the best corrected vision acuity, intraocular pressure measured by non-contact ophthalmometer, ophthalmoscope, corneal topography, corneal thickness, and slit lamp microscope were performed to preclude the development of other ocular diseases. The time points of follow-up study were set as before surgery and then one week, one month, three months, and six months post-operatively.

**Pre-operative treatment**

Levofloxacin eye drops were administered four times per day for three consecutive days pre-operatively.

**Surgical design and procedure**

Q-value acquisition: the patients were subjected to Orbscan corneal topography examination, repeated three times, using the Zyoptix program. The best acquisition images were chosen. The Q- and K-values were directly exported using K-Q Calculator software provided by Baush & Lomb Inc., US. Prior to the formal operation, the Q- and K-values were inputted into the Excimer laser; the diameter of optical-zone ablation was 6.0 mm (excluding transition zone). All surgical procedures were completed by two experienced surgeons. The Technolas 217 Excimer laser was utilized (Baush & Lomb Inc., US). A Hansatome Microkeratome blade was used. The corneal flap pedicle was located at the 12 o'clock position. The remaining procedures were performed with reference to standardized LASIK surgery. The diameter of surgical light district in LASIK was 6.0 mm (excluding transition zone).

**Post-operative treatment**

Eye patches were removed one day after surgery. Vision acuity, replacement and the healing status of the corneal flap were examined. Topical eye drops were given routinely after surgery<sup>2</sup>. The follow-up studies for 116 cases(232 eyes) endured > six months.

**Questionnaire design**

The questionnaire covered name, sex, age, career, educational level, pre-operative best-corrected vision acuity (filled out by our staff), post-operative glare, decreased night vision (yes or no), degree of satisfaction with post-operative visual quality (satisfied, average, or dissatisfied; blank lines left for detailed classification of average and dissatisfied responses).

**Statistical analysis**

All data were statistically analyzed using SPSS 13.0 software. A non-parametric test and an  $\chi^2$  test were employed to compare pre-operative data and ratio, respectively. *P*<0.05 was considered as statistically significant.

**Results**

**Post-operative vision acuity**

In the experimental group, 96% of patients had naked-vision acuity  $\geq 1.0$ , and 95% in the control group had this six-months post-operatively. In the experimental group, 5% of patients' best-corrected vision acuity decreased by 1 line after surgery, and the proportion in the control group was 6%. No statistical significance was noted between the two groups(*P*>0.05).

**Comparison of post-operative glare and night-vision acuity**

**Table 2** Comparison on glare and decreased night vision between two groups 6-month postoperatively

Groups	Number of cases	cases (%)	
		Decreased night vision	Glare
Experimental group	66	3 4.5%	13 19%
Control group	50	9 18%	21 42%
$\chi^2$		5.55	6.83
<i>P</i> value		0.029	0.013

**Subjective assessment**

**Table 3** Comparison on patients' satisfaction with visual life quality between two groups 6-month postoperatively

Groups	Number of cases	cases(%)		
		Satisfied	Average	Dissatisfied
Experimental group	66	48 73%	18 27%	0 0%
Control group	50	26 52%	24 48%	0 0%
$\chi^2$		5.29		
<i>P</i> value		0.031		

## Discussion

Acute myopia can cause much inconvenience to patients, both in terms of their careers, studies and everyday life. With the development and maturation of excimer laser corneal refractive surgery, in combination with the improvement in the safety coefficient of surgery, relatively high surgical efficacy has been attained in the treatment of acute myopia. However, post-operative visual function restoration has room for improvement. The improvement in naked-vision acuity is regarded as a vital indicator of the therapeutic effect of Excimer laser surgery<sup>3</sup>. In this study, more than 95% of the patients in the two groups were followed up for >six months and had naked-vision acuity >1.0, confirming the safety and predictability of LASIK surgery in the treatment of myopia and astigmatism.

Post-operative visual quality, such as glare and declined night vision, is a major concern. Corneal topography in normal individuals presents an aspheric surface, characterized as steep-top and flat-edge, yielding certain aberrations from the sphere. Following standardized LASIK surgery, the patients' cornea underwent significant transformations, changing from a prolate shape pre-operatively to an oblate shape post-operatively. The changes occurring in the sphere of the frontal surface of the cornea post-operatively can cause pronounced increments in high-order aberrations, mainly based on spherical aberrations, producing negative influence on visual quality in a small number of patients<sup>4</sup>.

It serves as the main reason for glare and declined night vision in few patients. The most significant advantage of Q-value-guided LASIK is that corneal-ablation depth declines, while ablation diameter increases. A relevant study revealed that high-order aberration was reduced as ablation diameter was increased<sup>5</sup>. Under the circumstance of enlarged pupil, light evades the ablation transition zone when penetrating the cornea, consequently lowering the incidence of spherical aberration. Surgeons should moderately enlarge ablation-zone diameter to minimize the increment in high-order aberration post-operatively within the safety range that the cornea permits. Clinical investigations also confirmed that night-vi-

sion quality is evidently ameliorated; additionally, the incidence of glare and halo is significantly decreased in the case of a relatively large corneal ablation zone during Excimer laser surgery in the treatment of myopia<sup>6</sup>.

Comparing the software processing between standardized LASIK and Q-value-guided LASIK under the same refraction, Q-LASIK is able to yield flattening ablation depth and an enlarged ablation zone; therefore, the patients have better night vision and seldom undergo glare post-operatively. In accord with the results given above, the current study found that the patients receiving Q-LASIK showed much better night vision and relatively less glare compared with those undergoing standardized LASIK. Night glare and declined night vision give rise to a considerable risk to those driving at night. LASIK with an aspheric ablation profile takes the aberration features of human eyes thoroughly into consideration, automatically adjusts the size and shape of the light spot according to the individual, and successfully completes the most complicated corneal ablation, effectively enhancing visual acuity. Based upon the questionnaire surveys distributed to all patients post-operatively, LASIK with an aspheric ablation profile yields higher satisfaction than standardized LASIK, owing to improved post-operative night vision.

The extent to which patients are satisfied with post-operative visual quality is not only measured by normal objective examination, but also by patients' subjective sensation of visual quality following LASIK surgery. To sum up, LASIK with an aspherical ablation profile may be performed on patients who require high visual quality, have relatively high astigmatism and relatively long pupil diameter at night.

## References

- 1 Zhu YF, Guo XJ, Wang H, et al. Influence of LASIK on higher order aberrations of myopic eyes. *Journal of Optometry & Ophthalmology*, 2005; 7(1): 11-14.
- 2 Liu MG, Wang CF, Ma YN. The significance of screening for patients before excimer laser photorefractive surgery for the cornea. *Acta Academiae Medicinae Qingdao Universitatis*, 2007; 43(3): 253-255.
- 3 Xu HC. The efficacy of corneal flap created with 90 $\mu$ m blade combined with multi-zone abla- (conti to page 216)