European Journal of Ophthalmology / Vol. 13 no. 3, 2003 / pp. 257-259

Optical biometry before and after excimer laser epithelial keratomileusis (LASEK) for myopia

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PURPOSE. *In order to select the correct intraocular lens (IOL) for implantation, it is important to measure the eye length (biometry). The IOL Master from Zeiss-Humphry is frequently used for such measurements. Because this instrument employs an optical method, any irregularities on the corneal surface or any disturbances in corneal transparency could lead to mistakes in the measurements. The aim of this study was to determine whether eye length measurements obtained at the University Eye Clinic Regensburg, Germany with the IOL Master before and after excimer laser epithelial keratomileusis (LASEK) show any changes.*
METHODS. *Axial length was measured on 20 myopic eyes (-2.75 to -8.00 diopters) before and one month after LASEK using the IOL Master.*
RESULTS. *The mean pre-operative eye length was 25.46 mm (SD±1.03) and the post-operative mean length was 25.38 mm (SD±0.99). There was a strong correlation between the pre- and post-operative eye lengths (Pearson correlation coefficient 0.998).*
CONCLUSIONS. *Although LASEK can lead to increased light scattering due to irregularities of the corneal surface and changes in corneal transparency, there is no difference in biometry pre- and post-operatively. (Eur J Ophthalmol 2003; 13: 257-9)*

KEY WORDS. *Biometry, IOL Master, Cataract surgery, LASEK*

Accepted: August 29, 2002

INTRODUCTION

Since the introduction of excimer lasers for refractive surgery into clinical trials in 1989, several million people have undergone this type of surgery, and the number of procedures is expected to continue increasing. Because most of these patients are operated during their second or third decades of life, there will be a corresponding increase in the number of cataract operations required later in eyes that have undergone excimer laser keratorefractive surgery (photorefractive keratectomy (PRK), laser *in situ* keratomileusis (LASIK), or excimer laser epithelial keratomileusis (LASEK).

In the last few years, there have already been some reports of cataract surgery after excimer laser keratorefractive surgery (1-13). A common problem was finding the correct power of the intraocular lens (IOL) to be implanted. If the implanted IOL is too weak the patient may end up hyperopic, even though emmetropia was the desired result.

The power of the IOL to be implanted is based on keratometry readings and axial length measurements (biometry). As excimer laser keratorefractive surgery is performed on the surface of the cornea (PRK, LASEK) or intrastromally (LASIK), irregularities of the corneal surface or morphologic changes in the corneal stroma can result in a loss of corneal transparency and increase light scatter. This is of major importance be-

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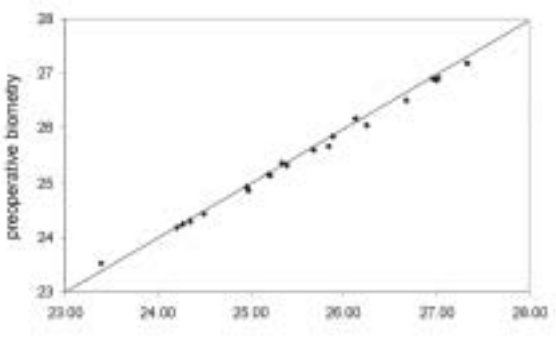

Fig. 1 - *Preoperative and postoperative biometry measured by the Zeiss-Humphrey IOLMaster. There is a strong correlation between the preoperative and postoperative measurements (correlation coefficient 0.998).*

cause one way of measuring the axial length the optical method using the IOL Master from Zeiss, is based on partial coherence interferometry (13). Any major disturbances in the regularity of the corneal surface or the transparency of the corneal stroma can therefore lead to incorrect measurements of the total length of the eye.

The aim of this study was to see whether there are changes in the eye length measurements obtained by the IOL Master before and after LASEK, a technique that leads to irregularities of the corneal surface and slight changes in corneal transparency.

PATIENTS AND METHODS

Twenty patients (20 eyes) between 21 and 34 years of age with a pre-operative myopia correction between -2.75 and -8.00 diopters (D) (mean -4.84 D; SD±1.45 D) were included. The astigmatism was less than 0.50 D. The surgical technique of LASEK has been widely described. In all eyes, we aimed for emmetropia, and all eyes were within (0.50 D of emmetropia one month after surgery. In most eyes (18/20), no disturbance in corneal transparency was visible, only two showing very faint haze. The results were compared and the statistical analysis was done with the Excel and SPSS computer programs.

RESULTS

In all eyes, the LASEK procedure was completed without complications. In particular, no epithelial instability was observed in the postoperative period of observation. As an indicator of the regularity of the corneal surface, the mean uncorrected post-operative visual acuity after one month was 0.93 (SD±0.23).

Prior to LASEK, the length of the eye ranged from 23.39 to 27.09 mm (mean 25.46 mm, SD±1.03). One month after the surgery, measurements ranged from 23.51 to 26.91 mm (mean 25.38 mm, SD±0.99). There was a significant correlation between the pre- and post-operative eye lengths (Pearson correlation coefficient 0.998), indicating that there were no significant difference between pre-operative and post-operative values (Fig. 1).

DISCUSSION

One of the most important steps in attaining the desired refractive outcome after cataract surgery with IOL implantation is precise measurement of the axial length of the eye (14). The standard technique is ultrasound A-scan, which has continuously improved since its introduction in 1956 (15). To our knowledge, the ultrasound technique shows no inaccuracy in axial length measurements after PRK (7) and problems in IOL calculations after excimer laser keratorefractive surgery are more related to the keratometry readings (16).

The disadvantage of ultrasound biometry is the need for actual contact between the ultrasound probe and the ocular surface. This requires topical anesthesia and involves a risk of infection. Furthermore, the contact of the ultrasound probe may cause some pressure on the cornea, which could affect the axial length measurement. This has led to the development of a non-invasive optical biometry technique based on the principle of partial coherence tomography (12). This system, the IOL Master, has been commercially available from Zeiss-Humphry since 1999.

The IOL Master uses a laser diode emitting an infrared light beam (λ = 780 nm) of short coherence light (approximately 160 µm). This laser light is emitted onto a beam splitter, which produces two coaxial beams by means of a fixed reference mirror and a moving

measurement mirror. These beams are directed into the eye, where they are reflected at the cornea and the retinal pigment epithelium. Interference between the reflected beam components occurs if the path difference between the partial beams is smaller than the coherence length. The resulting intensity distribution is measured by a photodetector and recorded as a function of the displacement of the measurement mirror.

Optical biometry gives reliable measurements of eye length for IOL calculation in cataract surgery (17, 18). However, in 5-15% of eyes, optical biometry cannot be done (18). Among various reasons for optical biometry failure are corneal scarring due to loss of corneal transparency or an irregular corneal surface. A transient and usually marginal loss of corneal transparency, and irregularities of the corneal surface, are common after excimer laser surface ablation (PRK, LASEK) and therefore may lead to wrong measurements of axial length using optical biometry. However, our results have shown that post-operative measurements of axial length are highly comparable to pre-operative measurements, even only one month after the operation, when the corneal surface is still very irregular. In conclusion, it is not necessary to measure the axial length of the eye prior to excimer laser keratorefractive surgery.

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