



# Evaluating the Relation of Refractive Surgery and Glaucoma

Kozobolis V\*, Kostantinidis A and Labiris G

Department of Ophthalmology, University of Thrace, Greece

## Editorial

Laser-assisted refractive corrections constitute a large part of the ophthalmic surgeries that take place every year. It is estimated that about 4 million refractive procedures were performed in 2014 throughout the world. On the other hand, glaucoma is an optic neuropathy, the incidence of which is increasing steadily over time. Given the frequency of refractive surgeries and the incidence of glaucoma in the general population it becomes necessary for the ophthalmologist to assess the risks of a refractive surgery in a glaucoma patient or a patient at a risk of developing glaucoma in the future.

The factors to take into consideration are: the family history of glaucoma, intraocular pressure (IOP), myopia, high vertical cup-to-disc ratio, central corneal thickness, and race, other ophthalmic diseases, hypermetropia, previous antiglaucoma procedure, visual fields and modern imaging modalities.

The advantages of these modalities include objective and reproducible measurements that can be compared with future measurements. The disadvantage is that their databases (although constantly enriched) include limited number of people, while "unusual" discs (tilted, high ametropias) are excluded from the databases. Unfortunately many candidates for refractive surgery have optic discs with "unusual" appearance that cannot be meaningfully compared with the "normal" optic discs of the databases. In these cases the digital photographing of the optic disc and the comparison with future photos will give valuable information about the changes of both the optic nerve and retinal nerve fibers.

## Intraoperative Risk Factors for Glaucoma Progression

Although that during the corneal flap creation in LASIK the intraocular pressure can go as high as 90 mmHg [1,2], the structure and function of the optic nerve and the nerve fiber layer do not seem to be affected [3-6].

However cases of ischaemic optic neuropathy following LASIK and epi-LASIK that can cause permanent damage to the optic nerve have been reported [7-9].

The visual fields, as assessed by automated static perimetry, do not seem to be affected after refractive surgery in the glaucoma and normal population [10]. Nevertheless there have been reports of visual fields deterioration in people with and without glaucoma [11,12]. It is possible that a small group of glaucoma patients are prone to developing optic nerve damage following an elevation of the IOP during LASIK, but the visual fields defects are either very mild or masked by learning effect of the visual field examination [10].

## Postoperative patient assessment

**IOP measurement:** Both PRK [13-15] and LASIK [16,17] cause a reduction of the postoperative IOP which depends on the depth of the ablation and the preoperative IOP level. The postoperative reduction of the IOP is due to the thinning of the corneal stroma, the change in corneal curvature, the instability of the corneal flap (LASIK) [17,18] and the removal of the Bowman's layer (PRK) [13]. In order to overcome the problem of the postoperative IOP underestimation with the Goldmann tonometer some authors suggest that the measurement (in myopic eyes) is done in the periphery of the cornea where less corneal tissue is removed [15].

The pneumatonometer records a lower IOP postoperatively [17,19], but the underestimation may be lower than that of the Goldmann tonometer [15,20].

Tonopen's advantage is that it can record IOP measurements from the periphery of the cornea

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### \*Correspondence:

Kozobolis V, Department of ophthalmology, Democritus University of Thrace Alexandroupolis, Greece, Tel: +3025510 – 30990; Fax: +3025510 39891;

E-mail: vkozompo@med.duth.gr

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where the measurement is considered more representative of the true intraocular pressure as the stromal thinning and the change of curvature are smaller there [21-23].

The Pascal Dynamic Contour Tonometer (DCT) understates to a lesser extent the IOP compared to the Goldmann tonometer after both LASIK and PRK [24,25].

**Effect on the corneal viscoelastic properties:** Several studies have shown that the viscoelastic properties of the cornea are reduced after LASIK because of the corneal thinning and the creation of the corneal flap [26]. The post-operative estimation of the IOP with the ORA's IOPcc reading and Corvis ST are the most accurate methods [27].

**Interface fluid syndrome, IFS:** Fluid accumulation between the corneal flap and the underlying stroma after LASIK surgery acts as a "cushion" resulting in a falsely low IOP reading as measured with the Goldmann tonometer, while the IOP with other tonometers may be measured correctly high [28].

**Steroid responders:** Increased IOP leads to a spectrum of clinical manifestations in the cornea that ranges from a simple rise of the IOP, to pressure induced stromal keratitis (PISK) and IFS [29,30]. In the early stages of the IOP rise there is stromal swelling which causes corneal haze. The corneal swelling then leads to fluid accumulation between the corneal flap and the stroma. If there is fluid accumulation under the flap the IOP should be measured with a tonometer other than the Goldmann tonometer so as not to miss the diagnosis of IFS.

**Corneal permeability after refractive surgery:** Studies in patients have shown that the corneal permeability increases after PRK and LASIK surgery and the deeper the ablation, the higher the corneal permeability [31-32].

**Topical antiglaucoma medication after refractive surgery:** Unfortunately little evidence exists about the effectiveness of the topical antiglaucoma drops in refractive patients [33,34].

In summary every young glaucoma patient should be treated as a future glaucoma patient and baseline tests should be carried out preoperatively. In this way the ophthalmologist will be able to recognize the development of glaucomatous optic neuropathy in the future.

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