Effect of LASIK Surgery on Management of Glaucomatous Patients

Essay

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Introduction

An increasing number of people are undergoing refractive surgery, and those patients who also have glaucoma present a unique and serious set of considerations. Glaucoma is two to three times more prevalent among myopes ,the population of patients who most frequently undergo refractive surgery.(1)

Central corneal thickness is an important variable in the evaluation of applanation IOP and should be included in the assessment of any case of potential glaucoma or ocular hypertension, particularly in eyes with previous photoablative refractive surgery. (2)

Both corneal thickness and anterior corneal curvature affect IOP assessment in patients with myopic LASIK. Although correction formulas can be used to estimate the actual IOP, alternative methods should be investigated to assess IOP independent of corneal thickness and curvature.(3)

Thinning of the corneal stroma by laser in situ keratomileusis (LASIK) results in inaccurate low intraocular pressure (IOP) readings by Goldmann applanation tonometry (GAT). Dynamic contour tonometry (DCT) is a novel measuring technique, designed to measure IOP largely independent of corneal thickness and curvature. Significant decreases in IOP were recorded by GAT after LASIK for myopia. Measurements by DCT, however, did not reveal any significant changes in IOP.(4)

A steroid-induced rise in intraocular pressure after LASIK can cause transudation of aqueous fluid across the endothelium that collects in the flap interface. The interface fluid leads to inaccurately low central applanation tonometry measurements that obscure the diagnosis of steroid-induced glaucoma, serious visual loss may result. (5)

The GDx VCC is a scanning laser polarimeter which measures thickness of the retinal nerve fiber layer (RNFL). A perpendicular incident laser beam in the RNFL is a prerequisite of a correct measurement of the thickness of this layer. An error in refractive correction could cause an obliqueness of the laser beam and consequently a deviation of the RNFL thickness reading. (6)

LASIK does not seem to change RNFL thickness. Reduction in RNFL thickness measurements after LASIK is a measurement artifact and is most likely due to erroneous compensation for corneal birefringence. With scanning laser polarimetry, it is mandatory to compensate individually for change in corneal birefringence after LASIK to ensure accurate RNFL assessment. (7)

Visual field analysis depends on the ability of small luminance changes in the central and peripheral retina to stimulate the retinal ganglion cells. Complicated LASIK patients may have corneal scarring or corneal changes that reduce the transmission of this light stimulus, accounting for "false positives" and, to a lesser extent, "false negatives." The erratic responses make this important test unpredictable and useless.(8)

A visual field defect caused by ischemia of the optic disc is a possible complication of LASIK. Visual field changes in form of paracentral scotoma and inferior-temporal altitudinal defect may be found.so visual field testing should be performed before and after LASIK for patients with disk abnormalities, especially those with small discs or extensive peripapillary atrophy. (9)

Increased intraocular pressure associated with the microkeratome vacuum ring used during laser in situ keratomileusis may have precipitated optic nerve head ischemia and visual field defect. (10)

Refractive surgery patients are often treated with steroids after surgery for a variety of reasons, including the hope of decreasing corneal haze. Higher dosing frequency of topical as well as oral steroids has been

advocated in the management of post operative diffuse lamellar keratitis (DLK), The risk of topical steroids, especially in patients with glaucoma, is well documented. Pressure-induced stromal keratopathy (PISK) is a condition that looks clinically similar to DLK but is unresponsive to steroids and occurs later in the postoperative period. It responds to IOP-lowering agents. (1)

Aim of the work

Is to review the different points to be considered in management of glaucoma when LASIK surgery is performed.

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List of Abbreviations

BSCVA	Best Spectacle-Corrected Visual Acuity
CCT	Central Corneal Thickness
CH	Corneal Hysteresis
CPSD	Corrected Pattern Standard Deviation
CRF	Corneal Resistance Factor
DCT	Dynamic contour tonometer
DLK	Diffuse Lamellar Keratitis
DOT	Dynamic Observing Tonometer
GAT	Goldmann applanation tonometry
HGF	Hepatocyte Growth Factor
IOL	Intra Ocular Lens
IOP	Intra ocular pressure
IOPCC	Corneal-Compensated IOP Value
IOPG	Goldmann-Correlated IOP Value
KGF	keratinocyte growth factor
LASIK	Laser Stromal In Situ Keratomileusis
MD	Mean Deviation
NFL	Nerve Fiber Layer
OHT	Ocular Hypertension
OHTS	Ocular Hypertension Treatment Study
ORA	Ocular Response Analyzer
PA	Pulse Amplitude
PDS	Pigment Dispersion Syndrome
PISK	Pressure-Induced Stromal Keratopathy

POAG	Primary Open Angle Glaucoma
PRK	Photorefractive Keratectomy
RNFLT	Retinal Nerve Fiber Layer Thickness
SITA	Swedish Interactive Threshold Algorithm
SLP	Scanning Laser Polarimetry
VF	Visual Field

Introduction

Increasing numbers of people undergo refractive surgery, and those patients who also have glaucoma present a unique and serious set of considerations.[1]Glaucoma is two to three times more prevalent among myopes,[2,3]the population of patients who most frequently undergo refractive surgery. One study done by Hori-Komai et al (2002) reported that of the 2,784 patients who requested refractive surgery, 705 were rejected for various reasons, including thin cornea or small pupils, and in 0.7% of the cases the rejection was due to glaucoma.[4] Surgeons need to be aware of the problems unique to this population of patients and modify their treatment plan based on the status of the patient's glaucoma, to avoid a potentially disastrous outcome.[1]Corneal refractive surgery changes the central corneal thickness and corneal curvature, which in turn influences the measurement of IOP.[5,6,7]During the lamellar corneal dissection in LASIK, there is a dramatic, transient rise in IOP, which risks further glaucomatous nerve damage or retinal vein occlusion.[8,9]The presence of a functioning filtering bleb may affect the choice and outcome of refractive surgery or exclude the patient from having it altogether.[1]Patients with glaucoma are more likely to experience steroid-induced IOP elevation, and hence are at greater risk with steroids, which are commonly used after corneal refractive surgery.[1]There have also been reports of inaccurate IOP readings after LASIK due to flap interface fluid, which could mask a dangerously high pressure.[10]

- **Glaucoma:**

Glaucoma is currently defined as a disturbance of the structural or functional integrity of the optic nerve that causes characteristic atrophic changes in the optic nerve, which may also lead to specific visual field defects over time. This disturbance usually can be arrested or diminished by adequate lowering of IOP. Nevertheless, some controversy still exists as to whether IOP should be included in the definition, as some subsets of patients can exhibit the characteristic optic nerve damage and visual field defects while having an IOP within the normal range.[11,12].

- **Open-Angle Glaucoma** :

Open-angle glaucoma is a progressive optic neuropathy characterized by acquired loss of retinal ganglion cells and atrophy of the optic nerve.[13]The rate at which patients with elevated intraocular pressure develop glaucomatous optic nerve damage is approximately 1 percent per year.[14]The pathophysiology of open-angle glaucoma includes a progressive decrease in the number of retinal ganglion cells when nerve fibers become pinched and die at the point where the optic nerve exits the eye. This condition leads to thinning of the neural rim and progressive enlargement of the optic nerve cup. The loss of nerve fibers causes a permanently decreased visual field.[15]Conversely, about 15 percent of patients with otherwise characteristic glaucomatous nerve damage have a consistently normal intraocular pressure (i.e., 21 mm Hg or less). These patients have normal-pressure glaucoma.[13,16]

- **Laser in situ keratomileusis(LASIK):**

LASIK is a procedure which aims at changing the refractive power of the cornea, i.e. to reduce or eliminate myopic, hyperopic or astigmatic defects.[17]It is performed by surgically making a lamellar corneal dissection, followed by excimer laser ablation of the stroma and then replacement of the dissected cornea. LASIK has evolved as the alternative to PRK for several reasons. LASIK offers more rapid visual recovery and much less pain and irritation immediately postoperatively. After LASIK, one doesn't see the occasional stromal haze or scarring that is seen with PRK. LASIK, when performed properly, offers a very high percentage of success.[18].

LASIK is so popular with patients because there is usually minimal irritation during and after the procedure. Most patients have blurry vision immediately after the surgery. They often describe it as if they had entered a "steam room" or had been "swimming with their eyes open," but vision improves rapidly. Many patients will have uncorrected visual acuities of 20/40 or even 20 /20 by their 24-hour follow-up visit. The cut edge of the corneal flap is usually almost undetectable by the next day, being already healed over with epithelium.[19]

Aim of the Essay

This essay aims at reviewing the different points to be considered in management of glaucoma when LASIK surgery is performed.