Cataract Surgery After Refractive Surgery

Essay

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By

Kareman Mohamed Taha Hamouda
M.B.B.ch Tanta University

Under Supervision of

Prof. Dr.

Hazem Hosney Nouh

Professor of Ophthalmology
Faculty of Medicine
Ain Shams University

Dr.

Mohamed Gamil Metwally

Assistant Professor of Ophthalmology
Faculty of Medicine
Ain Shams University

Faculty of Medicine
Ain Shams University
Cairo

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Kareman Mohamed Taha Hamouda

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LASIK	Laser assisted in situ keratomelusis
PRK	Photorefractive keratectomy
LASEK	laser-assisted subepithelial keratomileusis
CLE	Clear lens extraction
IOL	Intraocular lens
LVC	Laser vision correction
RK	Radial keratotomy
ACD	Anterior chamber depth
pIOL	Phakic Intraocular lens
AC	Anterior chamber
IF	Iris Fixated
PC	Posterior chamber
AL	Axial length
RLE	Refractive lens extraction
PMMA	Poly methyl metha acrylate
OVD	Ophthalmic viscoelastic device
ICL	Implantable collamer lens
PRL	Phakic refractive lens
ELP	Effective lens position
VHF	Very high frequency
Sim-K	Simulated keratometry
EffRP	Effective refractive power

D	Diopter
EffRPadj	Effective refractive power adjusted
EKR	Equivalent K reading
Roc	Radius of curvature
ANTroc	Anterior radius of curvature
OCT	Optical coherence tomography
BCVA	Best corrected visual acuity
NS	Nuclear sclerosis
BAB	Blood aqueos barrier
ASCs	Anterior subcapsular cataracts
PSC	Posterior subcapsular cataract
PCO	Posterior capsular opacification
IOP	Intraocular pressure

The surgical solutions to correct refractive errors exploit three anatomical possibilities**.**

Firstly, the cornea through small alterations to its anterior surface by sculpting methods afforded by the excimer laser (laser assisted in situ keratomelusis (LASIK), photorefractive keratectomy (PRK), or laser-assisted subepithelial keratomileusis (LASEK) as well as a number of mechanically based procedures, such as incisional, thermal, and additive techniques .

Secondly, the crystalline lens through clear lens extraction (CLE) plus IOL implantation.

Thirdly, a supplementary Intraocular lens (phakic IOL) implanted between the cornea and the lens*.* ***(Lovisolo and Reinstein, 2005)***

The refractive surgeries in relation to our topic are those affecting the cornea (Laser vision Correction (LVC), Radial keratotomy (RK)) and phakic IOL.

Myopic laser refractive surgery has among the highest satisfaction rate of all elective surgeries.

When patients who have had laser refractive surgery later have cataract surgery, they expect similar, excellent uncorrected visual acuity. Meeting these patient demands has been difficult because IOL

power calculations after laser refractive surgery are known to be less predictable than with virgin corneas**.**

The sources of prediction error in IOL calculations after laser refractive surgery have been divided into 3 categories: instrument error, index of refraction error, and formula error. ***(Hoffer, 2009; Haigis, 2008)***

A significant source of instrument error occurs because most keratometers measure the central corneal radius of curvature in a 2.5 to 3.2 mm zone and assume a sphero-cylindrical cornea that is no longer true after myopic laser refractive surgery**.** ***(Hamilton and Hardten, 2003; Rosa et al, 2004)***

Furthermore, when the anterior but not the posterior surface has been modified as after myopic laser refractive surgery, error due to index of refraction occurs because the relationship assumed in keratometers (index n=1.3375) between the 2 surfaces is no longer appropriate**.** ***(Masket, 2006)***

A third source of inaccuracy, formula error, occurs because the widely used third generation IOL power formulas (Holladay, Hoffer Q, SRK/T) use corneal power to predict the pseudophakic anterior chamber depth (ACD). Although the cornea is flattened after myopic laser surgery, the anterior chamber depth remains negligibly altered**.** ***(Haigis, 2008)***

Thus, when corneal power is corrected for instrument and index of refraction error, third generation formulas calculate a falsely shallow pseudophakic ACD and generate an inadequate IOL power prediction**.** ***(Aramberri, 2003)***

Together, unless corrected, these sources of error culminate in what has been termed the "hyperopic surprise" commonly observed after cataract surgery in post-myopic laser eyes. ***(McCarthy et al., 2011)***

Methods to correct or minimize these sources of prediction errors are divided into those requiring information from the prior laser surgery (historical) and those that use only current biometry (no history) ***(Hoffer, 2009)***.

Unfortunately, cataract surgeons will encounter situations when historical patient data are not available. Several formulas have been proposed to calculate IOL power in these situations. These include the contact lens method ***(Holladay, 1997),*** the Shammas method ***(Shammas, 2003),*** and others ***(Wang et al, 2004; Smith et al, 1998)***

There are recently published approaches, which attempt to calculate IOL power in patients for whom no prerefractive surgery information is available. From these approaches **pachymetric method**, measurement of anterior and posterior corneal power by **pentacam** ***(Naseri and Mcleod, 2010)*** and **optical coherence tomography** method**.** ***(Tang et al., 2010)***

These methods measure the true corneal power after refractive surgery and then used as input for IOL formulae that are specialized for post-refractive surgery cataract surgery.

Also in patients with previous RK they are liable to wound dehiscence during cataract surgery as they have radial incisions of unknown depth, often extending to the Limbus, limiting the space for safe placement of a corneal section for phacoemulsification. ***(Packer, 2012)***

There was a case report of wound dehiscence during clear corneal cataract surgery 11 months after RK, which necessitated suturing of the keratotomy incision**.** ***(Budak et al, 1998)***

Finally, a supplementary IOL (phakic IOL) implanted between the cornea and the lens, fixated in the angle, enclavated to the mid-peripheral iris with a claw or placed in the posterior chamber, gives rise to a condition called duophakia ***(Lovisolo and Reinstein, 2005)***, in those patients there are three problems in relation to cataract**.**

Firstly, Cataract development has been noted after Anterior chamber (AC), Iris fixated (IF), and Posterior chamber (PC) pIOL implantation. Several factors may be involved including surgical trauma, ***(Sanders et al, 2002)*** age,***(Uusitalo et al, 2002)*** pIOL–crystalline lens touch (including intermittent contact during accommodation), ***(Assetto et al, 1996)*** myopia**,** ***(Uusitalo et al, 2002)*** bioincompatibility of the pIOL, ***(Jime´nez-Alfaro et al, 2001)*** change