Intraocular pressure measurement using different techniques in normal eyes & post lamellar refractive Surgery a comparative clinical study

A Thesis submitted by

Shireen Mostafa Abdalla Shousha
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Under Supervision Of

Dr. Mahmoud Abo steit

Professor of Ophthalmology
Cairo University

Dr. Mohamed Hassan Hosny

Professor of Ophthalmology
Cairo University

Dr. Wael Ewais

Lecturer of Ophthalmology
Cairo University

Cairo University

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Abstract

Background Intraocular pressure (IOP) measurement post Lasik is a great debate, a large number of studies addressed .No previous studies as regards IOP measurement after Epilasik.

Purpose To determine accuracy of IOP measurement after Lasik and Epilasik surgeries using Goldmann applanation (GAT), Air puff tonometry, Ocular response analyzer (ORA IOP_{cc}) and Pentacam corrected IOP.

Methods This is a prospective comparative clinical study that was conducted on 60 eyes in the interval between February 2011 and September 2011 divided into 4 groups:(A) 20 corneas of patients before undergoing Lasik surgery, (B) 20 corneas of the same patients two months after Lasik surgery, (C) 10 corneas of patients before undergoing Epilasik surgery, (D) 10 corneas of the same patients two months after Epilasik surgery. Patients' age ranged from 20-50 years.IOP was measured prior to and after the suitable refractive surgery done using Goldmann applanation tonometry (GAT), air puff tonometry and Ocular response analyzer (corneal compensated IOP). Pentacam was used pre and post operative to measure both IOP and the central corneal thickness.

Results Significant positive linear correlations were found between preoperative IOP values measured by GAT (App pre) and air puff tonometry (Air puff pre), Pentacam corrected IOP (Pentacam pre), ocular response analyzer IOP_{cc} (ORA pre), as well as central corneal thickness (Pach pre) in Lasik patients "group A" .The correlation between each of Pentacam pre and ORA pre was the strongest to the GAT (r=0.97 and r=0.858 respectively with $p< 0.001$, Compared to the preoperative values, postoperative IOP measured by the four methods were significantly lower in both Lasik and Epilasik patients . The difference was significantly evident when the IOP was measured using the GAT and Air puff tonometry (median > 6 mmHg for Lasik patients, about 2 mmHg for Epilasik patients), compared to ORA and Pentacam corrected IOP (median ±1 mmHg for both the Lasik and Epilasik patients) "$p < 0.001$ for Lasik patients and 0.017 for Epilasik patients", Non significant correlations has been shown between the degree of lowering of postoperative IOP and postoperative pachymetry (central corneal thickness) (Pach post) values in both Lasik (group B) and Epilasik (group D) patients.

Conclusion Refractive surgery causes significant lowering of IOP measured using GAT, Airpuff tonometry, ORA and Pentacam. Lasik has more effect on fallacies of IOP measurement post refractive surgery than Epilasik.

Key words : Hand held ART - Ultra sound - Epipolis Lasik .

Table of contents

Table of Tables

Table of Figures

Abbreviations & Acronyms

A: Area

Air puff post: Postoperative value of Air puff tonometry

Air puff pre: Preoperative value of Air puff tonometry

Air puff Δ: Difference of IOP measured by Air puff tonometry pre and post operatively (post-preoperative value)

ALK: Automated lamellar keratoplasty

App-Air puff pre: Difference between preoperative IOP values measured by Goldmann applanation tonometry and Air puff tonometry

App-ORA pre: Difference between preoperative IOP values measured by Goldmann applanation tonometry and Ocular response analyzer

App-Pent pre: Difference between preoperative IOP values measured by Goldmann applanation tonometry and Pentacam corrected IOP

App post: postoperative value of Goldmann applanation tonometry

App pre: preoperative value of Goldmann applanation tonometry

Applanation Δ: Difference of IOP measured by Goldmann applanation tonometry pre and post operatively (post-preoperative value)

ARS: Applanation resonance sensor

ART: Applanation resonance tonometry

ART_{Biom}: Applanation resonance tonometry biomicroscope

ART_{Hand}: Hand held ART

$ART_{servo:}$ Servo controlled ART

BFA: Blood flow analyzer

CC: Corneal curvature

CCT: Central corneal thickness

CH: Corneal hysteresis

CRF: Corneal resistance factor

d.RCT: Dynamic rasterstereographic corneal topography

Eq: Equation

Epilasik: Epipolis Lasik

F: Force

FFKc: Forme fruste Keratoconus

GAT: Goldmann applanation tonometry

IOP: Intra ocular pressure

IOP_{cc}: Corneal compensated IOP

IOP_g: Goldmann correlated IOP

ISO: International standard organization

KMi: Keratoconus match index

Lasek: Laser assisted sub epithelial keratomileusis

Lasik: Laser assisted insitu keratomileusis

NTG: Normal tension glaucoma

NCT: Non contact tonometry

OAG: Open angle glaucoma

OBF: Ocular blood flow

OCT: Ocular coherence tomography

OHT: Ocular hypertension

OHTS: Ocular hypertension treatment study

ORA: Ocular response analyzer

ORA pre: Preoperative ORA IOP_{cc}

ORA post: Postoperative ORA IOP_{cc}

ORA Δ: Difference of IOP measured by Ocular response analyzer pre and post operatively (post-preoperative value)

p: Probability value

Pach post: Postoperative CCT

Pach pre: Preoperative CCT

Pach Δ: Pachymetry Δ=post-preoperative pachymetry

PDCT: Pascal dynamic contact tonometry

Pentacam pre: preoperative value of Pentacam corrected IOP

Pentacam post: postoperative value of Pentacam corrected IOP

Pentacam Δ: Difference of Pentacam corrected IOP pre and post operatively (post-preoperative value)

PEX: Pseudo exfoliation syndrome

PRK: Photo refractive keratectomy

r: Spearman correlation coefficient

TM: Trabecular meshwork

US: Ultra sound

VA: Visual acuity

Introduction & Aim of Work

Introduction

Intraocular pressure (IOP) measurement plays a central role throughout ophthalmology. It is part of routine ophthalmologic examinations and important in the management and follow-up of glaucoma patients.

At least half of the population diagnosed with open angle glaucoma (OAG) is asymptomatic. There are substantial variations in prevalence throughout the world due to genuine differences in populations but also due to methodological differences, such as differences in diagnostic criteria and sampling methods [1] .

The most important risk factor for the development [2] and the progress of OAG is elevated IOP [3]. Elevated IOP is still the only risk factor that is modifiable [4] other ocular risk factors include thin corneas [5] and pseudo exfoliation syndrome (PEX) in combination with elevated IOP, which increase the risk for both OAG development and progression of the disease [1].

Refractive surgery has become increasingly popular in recent years. Laser assisted insitu keratomileusis (Lasik) has become popular in treating myopia since 1993 the structural modification of corneal properties, e.g. central corneal thickness (CCT) and corneal curvature (CC), by refractive surgery, has augmented the risk for measurement error of IOP and consequently brought attention to the IOP measurement**.**

New methods for IOP measurement and assessing corneal biomechanics are continuously under study and evaluation.

Aim of Work

The aim of this study is to:

● Determine the ease and accuracy of intraocular pressure measurement pre and post refractive surgery (Lasik and Epilasik) using the following methods:

Applanation tonometry

Air puff tonometry

Ocular response analyzer

Scheimpflug camera

●Comparing the results for the Lasik group to Epilasik group to determine effect of lamellar refractive surgery versus surface ablation on bias of IOP measurement after each of them.

Review of Literature