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Original Research Paper

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CHANGES IN RETINAL NERVE FIBER LAYER THICKNESS AFTER MECHANICAL MICROKERATOME-ASSISTED LASIK.

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ABSTRACT

Purpose: To evaluate the changes in retinal nerve fiber layer (RNFL) thickness following mechanical microkeratome assisted laser assisted in situ keratomileusis (LASIK) **Material and Methods:** This hospital based prospective study was carried out on 56 patients with myopia between -1 and -8.5D and myopic astigmatism of upto -2.5D, who underwent LASIK at the LASIK Centre in the Postgraduate Department of Ophthalmology, Government Medical College, Srinagar for a period of one and a half year (from April 2018 to October 2019). Intraocular pressure (IOP) was noted at all pre and postoperative examinations. RNFL thickness was measured using optical coherence tomography(OCT) prior to the surgery and at 1 month and 3 months postoperatively. **Results:** The mean age of the patients was 26.9± 4.71 years …. The study included 30(53.5%) males and 26(46.4%) females. At the end of 3 months, the mean spherical equivalent of refraction was -0.25 ± 0.469 compared to a preoperative mean of -4.71 ± 2.043. The mean pre-LASIK RNFL thickness was 105.24±5.43μm and the mean RNFL thickness post-LASIK was 103.96±6.25 μm, and 104.76±5.27μm at 1 month and 3 months respectively. The difference in the RNFL thickness before and after LASIK was not statiscally significant (p value>0.05).The IOP was within the normal range both pre and postoperatively. **Conclusion:** LASIK performed in young myopic subjects does not significantly affect the retinal nerve fiber layer thickness as determined by optical coherence study.However the long term effects of the procedure on the optic nerve and RNFL are not clear and require further evaluation.

KEYWORDS :

INTRODUCTION

LASIK has become a commonly performed and widely accepted refractive surgical procedure for the treatment of myopia, hypermetropia and coexisting astigmatism. With the newer advances in laser technology and surgical techniques, the visual outcomes and safety profile of this procedure has significantly improved. In this procedure, a lamellar flap is formed with a microkeratome or scanning pulsed laser and the excimer laser ablation is performed. During the creation of the corneal flap, the suction ring is applied to fixate the globe, which causes an increase of intraocular pressure 1.The intraocular pressure can rise upto 77 to 229 mmHg as reported in various studies 2,3. Such rapid increase and then decrease in IOP could theoretically stretch the vitreous base and the acoustic shock waves from laser could lead to posterior vitreous detachment, retinal breaks and retinal detachment in predisposing patients. Other complications that may occur include choroidal neovascularization, disruption of Bruch's membrane, macular hemorrhage and macular hole formation 2. As visual enhancement through LASIK is mostly sought by myopic patients, the concerns about the effect of LASIK on retinal nerve fiber layer and optic nerve are justified4.

Various imaging techniques currently available to provide quantitative measurements of RNFL thickness include scanning laser slit-lamp microscopy, scanning laser polarimetry, and OCT. Among these, OCT is a useful non invasive imaging device that provides a real-time in vivo high resolution view of the retina 5. The aim of this study is to evaluate the changes in retinal nerve fiber layer following LASIK and to determine whether an increase in intraocular pressure during the procedure leads to a decrease in RNFL thickness as assessed by OCT.

MATERIAL AND METHODS:

This study was conducted at the LASIK Centre in the Postgraduate Department of Ophthalmology, Government Medical College, Srinagar for a period of one and a half year (from April 2018 to October 2019).

Inclusion Criteria:

Patients fulfilling the following criteria were included : Age > 18 years , preoperative cycloplegic spherical refraction between -1.00D and -8.5D of myopia and upto -2.5D of myopic astigmatism, a stable refractive state (change<0.5D per year) for at least 1 year, preoperative BCVA > 6/9,sufficient corneal thickness for full correction with residual stromal thickness of at least 250 micron remaining beneath LASIK flap.

Exclusion Criteria :

We excluded patients with a history of any ocular disease, keratoconus or forme fruste keratoconus, connective tissue disorder, pregnancy or severe dry eye.

Procedure

A compete relevant ocular history was taken. Patients using contact lenses were instructed to discontinue the use (soft contact lenses for 2 weeks and rigid contact lenses for 4 weeks) before their preoperative assessment as well as before LASIK. The preoperative assessment included: Assessment of UCVA and BCVA, slit lamp biomicroscopy, specular microscopy, fundus evaluation, autokeratometry, corneal topography and pachymetry. IOP was measured with a non contact tonometer and spectral domain OCT was performed.

LASIK was performed at a single center using the Moria One Use-plus microkeratome(Moria Surgicals,France) . The eye was fixated by a suction ring using 60 mmHg negative pressure that was gradually built. The time of suction applied to the eye from "Suction ON" to "Suction OFF" was recorded in each case. A flap of 9mm to 9.5mm in diameter was created with an intended thickness of 110 m. Subsequent photo-ablation was conducted with the Carl Zeiss meditec AG's MEL 80(Germany) excimer laser. All eyes were treated in a routine manner with optical zone diameters ranging from 6.0 mm to 7.0 mm. Post-operative treatment consisted of moxifloxacin 0.5%, dexamethasone 0.1% drops four times daily for 1 week; and artificial tears every hour at day1 and 2,and four to six times a day thereafter for a duration of 2 to 10 weeks. Patients were examined on day 1 and 7 for any immediate complication, and then at 1month and 3 months following LASIK. In all cases IOP and OCT measurements were performed on each visit postoperatively.

We used Carl Zeiss Meditec AG, Jena, Germany which is a spectral domain OCT that uses a diode laser wavelength of 840 nm and a scan rate of at least 20,000 axial measurements per second, thus providing better resolution compared to earlier time domain OCT. Pupil was dilated using tropicamide 1% and phenylephrine 2.5% and all measurements were taken between 10 a.m. and 1p.m. to eliminate the effect of diurnal variations in IOP,and any possible effect on RNFL thickness.

Statistical Analysis

SPSS (version 20.0) and Microsoft excel were used to carry out the statistical analysis of data.Continous variables were summarized as mean and standard deviation and categorical variables as percentage.Normality analysis was done using Kolmogorov-smirnov test.Data was presented by bar diagrams and pie charts.Paired -t test was used for comparison of pre and post LASIK RNFL thickness and refraction. Values less than 0.05 was considered statistically significant.

OBSERVATIONS AND RESULTS

A series of 56 patients with myopia between -1 and -8.5D and upto -2.5D of myopic astigmatism in the age group of 19 to 36 years (mean age 26.9±4.71 years) were included in the study. Out of these 30(53.5%) were males and 26(46.4%) were females.The mean preoperative spherical equivalent was -4.71 ± 2.043D which reduced significantly to a mean value of -0.25 ± 0.329D (p-value of < 0.001) at the end of 3 months respectively. The mean IOP was between 10-21mm Hg both pre and post-operatively with no use of antiglaucoma medications. The mean "Suction ON" to "Suction OFF" time was 24 ± 1.4 seconds (range 20 to 40seconds).

The overall average RNFL thickness values, as well as the values in each quadrant in both pre-LASIK and 1 month and 3 months post-LASIK were noted as shown in Table 1.

Table 1: Mean RNFL Thickness Value In µm Before And After LASIK

Parameter	Pre-LASIK	Post- LASIK		P value*	
		1 Month	3 Months	Preop vs 1 Month	Preop vs 3 months
Average RNFL thickness	105.24± 5.43	103.96± 6.25	104.76±5 .27	0.381	0.654
Superior Average	119.64± 5.07	118.86± 4.39	117.46±4 .85	0.569	0.863
Inferior average	122.73 ±6.28	120.94± 6.33	119.48±5 .78	0.412	0.097
Temporal average	77.88 ±4.23	78.83±3. 69	76.56±3. 98	0.635	0.549
Nasal average	85.68 ±5.40	83.36±4. 81	86.22±5. 79	0.297	0.517

*P-value by Paired t-test

DISCUSSION

OCT is a non invasive cross sectional imaging technique with high axial 121 resolution that can be used for morphological evaluation and quantitative analysis of retinal structures. We used a spectral domain OCT to evaluate the changes in RNFL thickness in patients who underwent micro-keratome assisted LASIK for the treatment of myopia. Myopia itself is a risk factor for glaucoma and retinal damage and with increasing number of patients opting for LASIK as a treatment, it becomes imperative to evaluate whether this procedure has any adverse effect on retinal health. The present study showed that there was no significant change in RNFL thickness following LASIK as noted at 1 and 3 months post LASIK. Our study is consistent with the study conducted by Feng Lei et al 1 and Hosny et al 6 who found that most retinal OCT measurements undergo no obvious changes after myopic Lasik.

Hosny et al 6 also observed that the rise of IOP during application of suction ring in LASIK does not affect the RNFL thickness as measured by SD-OCT, irrespective of whether the flap is created by micro-keratome or femtosecond laser. In their study the average preoperative RNFL thickness was 94.6 ± 12.1µm in MMK group while the postoperative average thickness was 95.1 ± 11.9 um with no statistically significant difference (P-value: 0.37).

However Gürses-Özden et al7 and Tsai et al 8 observed that RNFL thickness decreases following LASIK when measured by conventional scanning laser polarimetry (SLP) with a fixed corneal compensator.Later Daba et al 9 found that no changes in RNFL thickness is noted when measured with glaucoma diagnostic variable corneal compensator (GDx VCC; Carl Zeiss Meditec AG).

They concluded that changes in RNFL thickness measurements when measured with SLP with a fixed corneal compensator may be attributed to altered corneal birefringence, and may not be actually present. Hosny 10 evaluated other parameters of RNFL function and found no visual field changes following LASIK. Certain studies 11-16 have also shown that there is decrease in IOP occurs following LASIK which may be attributed to biomechanical alterations in the cornea and changes in corneal stiffness after LASIK leading to a false low IOP.nIn our study both the preoperative and postoperative IOP was within the normal limits when measured with the non contact tonometry.

The safety and efficacy of LASIK has been extensively studied and documented in previous studies17-19. Posterior segment complications are rare and majority of the studies20 do not show any significant relationship between myopic LASIK and any retinal changes. The major limitation of our study was the short period of follow up. However further studies are necessary to evaluate the long term effects of this procedure on visual field stability ,ganglion cell layer and other parameters of retinal function.

CONCLUSION:

LASIK performed in young myopic subjects does not significantly affect the retinal nerve fiber layer thickness as determined by optical coherence study.

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