

Comparison of foveal thickness (as measured by OCT) before and after uncomplicated phacoemulsification with PCIOL implantation in cataract patients without diabetes mellitus and cataract patient with diabetes mellitus without diabetic retinopathy and diabetic macular edema

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Abstract

Aims And Objectives: To study the influence of uncomplicated phacoemulsification surgery with PCIOL implantation on fovea in non-diabetic patients and diabetic patients without DR and DME

Objectives: To evaluate the natural course of foveal thickness in cataract patients during preoperative and postoperative period undergoing uncomplicated phacoemulsification surgery with PCIOL implantation without diabetes mellitus and with diabetes mellitus without DR and DME.

Method: The study was conducted on 60 patients which were equally divided into Group I consisting of 30 diabetic patients without diabetic retinopathy and macular edema and Group II consisting of 30 non-diabetic patients who underwent uncomplicated phacoemulsification with PCIOL implantation in Department of Ophthalmology, Maharishi Markendeshwar Institute of Medical Sciences and Research (MMIMSR), Mullana (Ambala). In all study patients central macular thickness using Cirrus High Definition (HD) OCT and best Corrected Visual Acuity

(BCVA) in Logarithm Minimum Angle of Resolution (LogMAR) was recorded preoperatively and postoperatively on Day 7, 1 month, 3 months and 4 months to see changes in the macular thickness.

Conclusion: The Central Macular thickness and the visual Outcomes in diabetic patients without retinopathy and macular edema undergoing uncomplicated phacoemulsification with posterior chamber intraocular lens were statistically significant at postoperative day 7, 1 month and 3 months as compared to the non-diabetic patients who underwent uncomplicated phacoemulsification with posterior chamber intraocular lens. Therefore the short term post cataract surgery increase in Central Macular Thickness (CMT) and visual recovery in diabetic patients without diabetic retinopathy and macular edema is different than the non-diabetic group

Keywords: CMY, OCT, VEGF.

Introduction

Cataract is one of the commonest cause of blindness worldwide usually requires surgical removal.⁽¹⁾ , Phacoemulsification with posterior chamber IOL implantation is the most frequently performed surgery for cataract extraction. It is an efficient procedure associated with good visual prognosis.⁽²⁾ During Cataract extraction there is release of mediators of inflammation which may lead to Cystoid macular edema (CME).

Ocular complications of diabetes mellitus may include diabetic retinopathy, cornea abnormalities, glaucoma, iris neovascularization (NVI), cataracts and neuropathies. Cystoid Macular Edema (CME) is formation of fluid-filled cystoid spaces resulting from the breakdown of blood retinal barrier between outer plexiform and inner nuclear layers of retina, leading to increase in foveolar thickness. Reason for decrease in

postoperative vision is usually Cystoid Macular Edema.⁽³⁾ Visual acuity is inversely related to the foveal thickness.

According to a study using OCT for post-cataract macular edema evaluation, Cystoid Macular Edema was found in 22 % of patients with diabetes at 1 month post-cataract extraction.⁷ Surgical trauma and ensuing inflammation after cataract surgery in eyes of diabetics increase the levels of vascular endothelial growth factor (VEGF) and other inflammatory cytokines.⁴

OCT technique is a latest technology which is non-invasive, contactless and provide high resolution cross sectional image of retina & its layers. It is helpful in quantifying resolution of foveal and extra foveal macular thickening.⁵

Both qualitative as well as quantitative data is given by OCT that helps in estimating a relationship between cataract extraction via Phacoemulsification and ME in patients with diabetic retinopathy or patients with diabetes but without diabetic retinopathy.⁶

As in present era where Anti- VEGF injections are used as treatment option, OCT can differentiate between centre-involving or non-centre-involving diabetic macular edema.

Aim

To study the influence of uncomplicated phacoemulsification surgery with PCIOL implantation on fovea in non-diabetic patients and diabetic patients without DR and DME.

Material & Methods

It was a randomized prospective study conducted among the cataract patients with and without diabetes mellitus who underwent uncomplicated phacoemulsification and posterior chamber intraocular lens implantation at the Department of Ophthalmology

at Maharishi Markandeshwar Institute Of Medical Science And Research, Mullana, Ambala, Harayana.

The study included a minimum of 30 patients with type 2 diabetes mellitus without diabetic retinopathy and DME and 30 patients without diabetes mellitus (total 60 patients).

The study was conducted between 2021 to 2022 after approval by ethical committee of Maharishi Markandeshwar Institute of Medical Sciences and Research Mullana, Haryana, India.

Inclusion Criteria

1. Patients with Senile cataract with type 2 diabetes mellitus without diabetic maculopathy or diabetic retinopathy.
2. Uncomplicated phacoemulsification and posterior chamber intraocular lens implantation.
3. Age group more than 40 years.
4. Duration of diabetes mellitus minimum 5 years.

Exclusion Criteria

1. Eyes with high myopia, neuro-ophthalmic anomalies.
2. History of ocular diseases like glaucoma, Uveitis.
3. History of any ocular surgeries.
4. Related general complications of diabetes like severe diabetic nephropathy, uncontrolled hypertension or CVS disease.
5. Previous medical treatment of retinal disorder or any therapy that affect retinal edema.
6. Patients with refractive errors of more than +5 Diopters spherical or -8 Diopters spherical.
7. Intraocular Pressure more than 21 mmHg as determined by Goldmann applanation tonometry.
8. Patients with pre-existing Macular edema.
9. Any complication during surgery.

Method of Study

Informed and written consent in regional language will be taken prior to the study from each patient. From the patients the data will be collected using a piloted proforma, therefore meeting the objectives of the study by means of personal interview with the patient. Patients will be filtered out according to the data provided and only the patients fulfilling the inclusion criteria will be included in the study. Once the patient is selected for the study the detailed clinical history of the patient will be taken. All patients will undergo detailed ophthalmological examination pre-operatively and then at day 7, 1 month, 3 months and 4 months as follows:

- Best Corrected Visual Acuity (BCVA) and UCVA (uncorrected visual acuity) by using Snellen's Chart.
- Slit Lamp assisted Biomicroscopy of anterior segment.
- Slit Lamp assisted Biomicroscopy of Posterior segment with +90D.
- Intraocular pressure measurement (IOP) with Applanation Tonometry.
- Intraocular Lens (IOL) Power calculation using Keratometer and A-scan.
- All patients Diagnosed as cataract with diabetes mellitus without diabetic maculopathy and diabetic retinopathy will under phacoemulsification with PCIOL implantation in the bag under LA
- Foveal thickness will be recorded using Ciruss HD-OCT Model 500 (Carl Zeiss/ Meditec).

Pre-operative mydriasis was done using

- Eye drop Tropicamide 1 % and Phenylephrine 2.5 % Anaesthesia
- 8-10 ml Peribulbar block (xylocaine 2 % + eye drop bupivacaine 0.5 % + hyaluronidase 1500 IU) was given to patients before surgery.

Phacoemulsification

- A 2.8mm triplanner clear corneal incision on superior aspect of cornea is made.
- Two side port of around 1mm was made on temporal & nasal aspect of limbus.
- Continuous curvilinear Capsulorrhesis of around 6mm is made with cystitome through side port.
- Hydrodissection is done using BSS solution.
- Nucleus is then rotated in bag Phacotip is then used to emulsify the nucleus.
- Remaining cortical matter is then removed using bimanual irrigation & aspiration cannula.
- Posterior chamber Intraocular Lens is then implanted using an injector and Implanted IOL is then dialed.
- Remaining viscoelastic is removed using IA cannula.
- Intracameral moxifloxacin is given & ports are hydrated.
- Subconjunctival gentamycin & dexamethasone is injected & eye is patched with eye patched and bandaged applied

Post operative treatment

- Tablet Ciplox 500 mg twice daily x 5 days
- Tablet Combiflam as required
- Topical antibiotic eye drops (Moxifloxacin 0.5%) 2 hourly
- Topical steroid eye drops (Prednisolone acetate 1 %) 1 hourly
- Topical homatropine 2 % eye drops once a day x 1 week

On postoperative Day 7, 1 month, 3 months and 4 months patients were examined for:

- UCVA & BCVA using Snellen's chart and converted to Log MAR

- Slit lamp biomicroscopy of anterior segment
- Slit lamp biomicroscopy of posterior segment with +90 D /+ 78 D
- IOP measurements with Applanation tonometry
- Central Macular Thickness was recorded using Cirrus HD-OCT Model 500 (Carl Zeiss/ Meditec)

Data Entry And Statistical Analysis

The collected data were transformed into variables, coded and entered in Microsoft Excel. Data were analyzed and statistically evaluated using SPSS-PC 20 version.

Quantitative data was expressed in mean, standard deviation while qualitative data were expressed in percentage. Comparison between values measured preoperatively and postoperatively in carried out using Independent t-test. Statistical difference between the proportions were tested by chi square test. P value less than 0.002 considered statistically significant

Results

It was a hospital based prospective observational study conducted in Department of Ophthalmology of Maharishi Markendeshwar Institute of Medical Science and Research, Mullana in Haryana , enrolling a total of 60 patients divided in to two equal groups of patients . Group I - consisting 30 patients with diabetes mellitus without diabetic maculopathy and retinopathy Group II- consisting of 30 patients with no history of diabetic Mellitus .

The mean age in Group I and Group II was 59.83 years and 60.13 years. 16 (53.3 %) and 15 (50.0%) were male in Group I and II respectively while 14 (46.7%) and 15 (50.0%) were female respectively in the study population. Mean value of fasting blood sugar was 97mg/dl and 95 mg/dl in Group I and Group II

respectively & P value was 0.70 which is statistically insignificant.

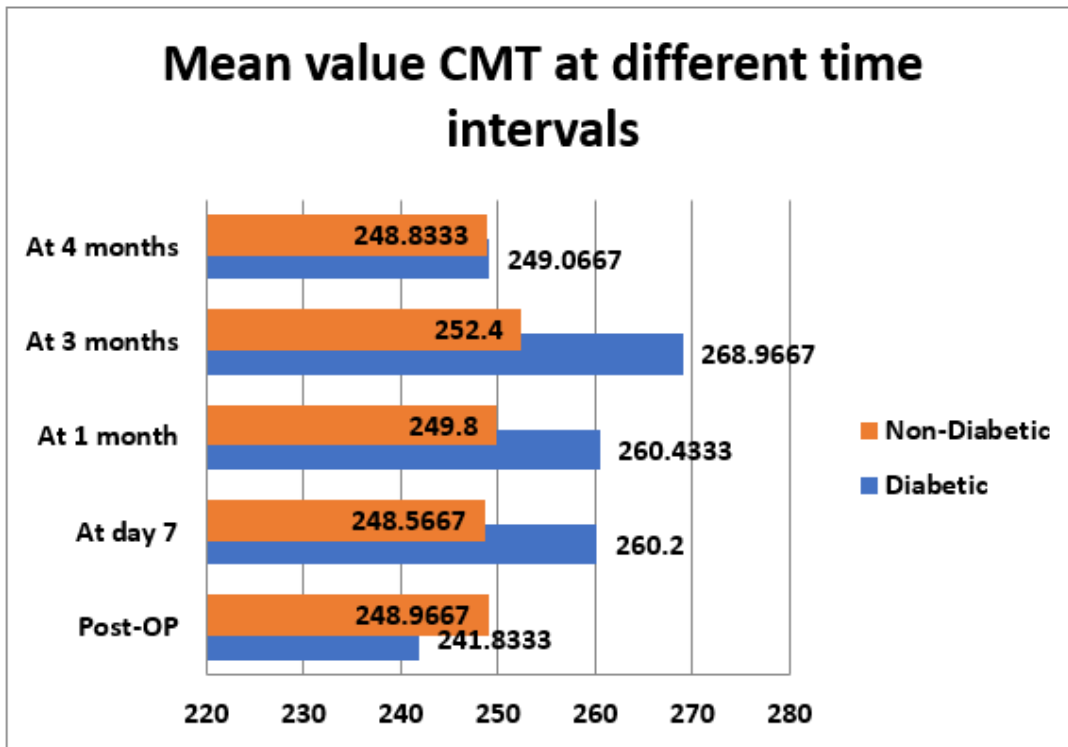
In Group I and II, there was significant increase in the mean Central macular Thickness at postoperative day 7, 1 month & 3 months (p <0.05) from the baseline values

of the mean Central Macular Thickness. However the Mean CMT between these groups was comparable and statistically significant as per the Independent sample t test .

Table 1: Comparison of mean CMT during follow up in patients

CMT	Diabetic		Non-Diabetic		p-value
	Mean	Std. Deviation	Mean	Std. Deviation	
Post-Op	241.8333	14.88597	248.9667	16.09344	0.080 (NS)
At day 7	260.2000	14.11382	248.5667	14.57131	0.003 (Sig.)
At 1 month	260.4333	12.90732	249.8000	15.72040	0.006 (Sig.)
At 3 months	268.9667	17.14137	252.4000	22.49383	0.002 (Sig.)
At 4 months	249.0667	14.86475	248.8333	15.40059	0.953 (NS)

Test applied: Independent sample t-test



Comparison of BCVA during follow up visits

The visual outcome evaluation by comparing the values of Best Corrected Visual Acuity (BCVA) in LogMAR .

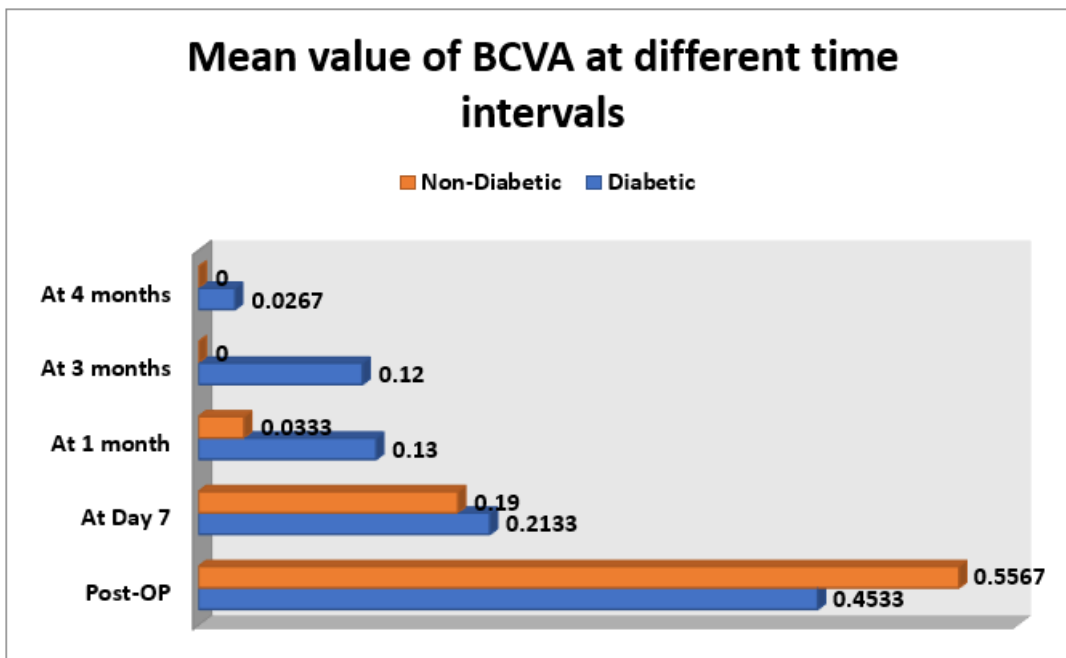
In both the groups there was significant improvement in BCVA at postoperative time intervals . BCVA was found to be statistically significant at 1 month, 3 months

,4 months after uncomplicated phacoemulsification as shown in table as well as in graphical presentation.

Table 2: Comparison of BCVA during follow up visits

BCVA	Diabetic		Non-Diabetic		p-value
	Mean	Std. Deviation	Mean	Std. Deviation	
Post-OP	0.4533	0.12243	0.5567	0.18511	0.013
At Day 7	0.2133	0.10417	0.1900	0.12415	0.434
At 1 month	0.1300	0.06513	0.0333	0.04795	0.001 (Sig.)
At 3 months	0.1200	0.08052	0.0000	0.00000	0.001 (Sig.)
At 4 months	0.0267	0.04498	0.0000	0.00000	0.002 (sig.)

Test applied: Independent sample t-test



Discussion

The present study was a hospital based prospective observational study conducted on 60 patients to compare Central macular thickness in diabetic patients without retinopathy and diabetic macular edema with non-diabetic patients who underwent uncomplicated phacoemulsification and posterior chamber intraocular lens implantation at our Department of Ophthalmology

of Maharishi Markendeshwar Institute of Medical sciences and Research, Mullana in Haryana, India.

It was observed in our study that in Group I and Group II there was statistically significant increase in the Central Macular Thickness (CMT) values at postoperative day 7, 1 month and 3 months ($p < 0.05$). Increase in the CMT between groups were comparable and statistically significant as per Independent Sample t-test. The mean

difference in Central Macular thickness on post operative day 7, 1 month and 3 months was significantly more in Group I as compared to Group II ($p < 0.05$). This is concordant to the following studies

Katsimpris JM et al,⁸ in a prospective study evaluated and compare macular thickness changes after cataract surgery between non diabetic and diabetic patients (with type 2 diabetes) without retinopathy, using OCT. OCT was done preoperatively as well as postoperatively at 1, 3, 6 and 12 months. CMT was assessed and differentiated between groups. Postoperative CMT in diabetic patients during follow-up period was markedly increased when compared to controls (1st month, normal: $215 \pm 28 \mu\text{m}$ vs. diabetics: $262 \pm 33 \mu\text{m}$, $p < 0.05$; 3rd month, normal: $211 \pm 19 \mu\text{m}$ vs. diabetics: $250 \pm 27 \mu\text{m}$, $p < 0.05$; 6th month, normals: $208 \pm 12 \mu\text{m}$ vs. diabetics: $266 \pm 13 \mu\text{m}$, $p < 0.05$; and 12th month normals: $209 \pm 13 \mu\text{m}$ vs. diabetics: $280 \pm 11 \mu\text{m}$, $p < 0.05$). This study stated that diabetic patients without retinopathy presented increased CMT and a increased incidence of CME after cataract surgery on OCT examination compared non diabetic patients . This may explain the dissatisfying visual acuity after cataract surgery in these patients.

Gerasimos Th Georgopoulos et al. conducted a study on foveal thickness after phacoemulsification as measured by OCT implying that following cataract surgery i.e. phacoemulsification , there was an increase in the foveal thickness in the early postoperative period, quantified and followed up by OCT.⁹

A Prospective study was conducted on foveal thickness alterations after cataract surgery on assessed by OCT conducted by Miltiadis Tsilimbaris et al on patients divided into 4 groups i.e. history free patients ,patients with diabetes mellitus without macular involvement,

patients with glaucoma and patients with epiretinal membrane . Preoperatively and 1, 3 and 6 months postoperatively, patients were evaluated for ,mean foveal thickness by optical coherence tomography . Study concluded that foveal thickness values increased markedly in all groups at the first and third months after cataract surgery. At 6 months, MFT values returned to preoperative levels in the history free and glaucoma patients, while foveal thickness remained significantly higher in diabetic and ERM patients .¹⁰

In our study there was significant correlation between central macular thickness and BCVA (LogMAR) post-operatively at day 7, 1 month and 3 months. Katsimpris JM et al,⁸, Degenring RF et al,¹¹, Miltiadis Tsilimbaris et al⁹ noted similar observations in their study.

Conclusion

The Central Macular thickness and the visual Outcomes in diabetic patients without retinopathy and macular edema undergoing uncomplicated phacoemulsification with posterior chamber intraocular lens were statistically significant at postoperative day 7, 1 month and 3 months as compared to the non-diabetic patients who underwent uncomplicated phacoemulsification with posterior chamber intraocular lens. Therefore the short term post cataract surgery increase in Central Macular Thickness (CMT) and visual recovery in diabetic patients without diabetic retinopathy and macular edema is different than the non-diabetic groups.

Recommendation

From the observations made during the course of the study and considering the results and discussion of the present study, it was found the central macular thickness increase in the diabetic patients without diabetic retinopathy and macular edema after phacoemulsification.

After cataract surgery extraction, clinicians should continue to maintain vigilance in diabetic patients, and OCT should be used before surgery to establish baseline measurements which will help to assess the risk of macular thickness development.

Studies with large sample size and longer follow up are needed to assess the risk of increase in CENTRAL MACULAR THICKNESS progression after cataract surgery in diabetic patients and to see whether increase in Central Macular Thickness after phacoemulsification is temporary or permanent.

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