



RESEARCH ARTICLE

EVALUATION OF CENTRAL MACULAR THICKNESS AFTER PHACOEMULSIFICATION IN NON-DIABETIC PATIENTS MORE THAN 40 YEARS OLD

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ABSTRACT

Purpose: To assess the central macular thickness after phacoemulsification surgery.

Methods: Twenty eyes of 15 non-diabetic, more than 40 years old patients, who underwent uneventful phacoemulsification, central macular thickness using swept source optical coherence tomography was estimated preoperatively and four weeks postoperative.

Results: The central macular thickness increased with highly significant degree from (248.35 ± 30.10) preoperative to (271.90 ± 36.49) four weeks postoperative (p=0.006), only one eye developed cystoid macular edema representing 5% of patients. There was high significant improvement of visual acuity. The BCVA increased highly significant from 0.67 ± 0.21 on log MAR preoperatively to 0.38 ± 0.231 week post operatively and to 0.24 ± 0.23 four weeks postoperatively (p=0.000).

Conclusion: There was a significant increase in CMT 4 weeks postoperatively.

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INTRODUCTION

Macular oedema occurs when fluid and protein deposits collect within the macula, leading to thickening and swelling which distorts central vision. It is a common final pathway for many ocular diseases, including diabetes mellitus, vascular occlusions, postsurgical conditions and uveitic diseases (Coscas *et al.*, 2010). The occurrence of pseudophakic macularedema peaks at approximately 4-6 weeks postoperatively. The most common presentation is blurry vision; less common presentations include central scotomas, metamorphopsia, and mild photophobia (Gabriel *et al.*, 2010). Foveal thickness for normal subjects was measured to be 229±20.46 µm and never exceeded 252 µm in any of the healthy eyes, central foveal thickness is 182 ± 23 µm in the healthy eyes (Annie *et al.*, 2006). One of the causes of macular edema is replacement of the lens as treatment for cataract which can cause pseudophakic macular edema, also known as Irvine-Gass syndrome. This surgery sometimes irritates the retina (and other parts of the eye) causing the capillaries in the retina to dilate and leak fluid into the retina (Ecsedy *et al.*, 2011).

The pathophysiology of cystoid macular edema (CME)

The vitreous, retina, retinal pigment epithelium and choroid receive their circulation through the retinal and choroidal vasculature. This relies upon an intrinsic balance amongst the osmotic force, hydrostatic force, capillary permeability and tissue compliance in the vasculature. Once imbalance occurs, an accumulation of fluid is seen in cystoid spaces within the inner layers of the retina. Vitreomacular traction is a common underlying factor which contributes to the release of inflammatory factors such as vascular endothelial growth factor (VEGF) and platelet-derived growth factor. This results in the blood-retinal barrier (BRB) breakdown, leakage and edema¹⁸. In 1953, Irvine described a cystoid macular edema that specifically arised after cataract surgery¹¹. Approximately 20% of the patients who undergo uncomplicated phacoemulsification develop angiographically proven CME. However, a clinically significant decrease in visual acuity is seen only in about 1% of these eyes¹⁷.

PATIENTS AND METHODS

This study included 20 eyes of 15 non-diabetic more than 40 years old patients. All patients were admitted for Phacoemulsification cataract surgery and foldable posterior chamber IOL implantation at Bab Al-Sharia University Hospital.

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Table 1. Comparison between preoperative, 1week and 4weeks postoperative best corrected visual acuity

		Preoperative	1week post operative	4weeks post operative	
Best corrected visual acuity (LogMAR)	Mean ± SD	0.67 ± 0.21	0.38 ± 0.23	0.24 ± 0.23	P-value
	Range	1.3– 0.00	0.76– 0.00	0.76– 0.00	
		...	0.000	0.000	

P > 0.05: Non significant P < 0.05: Significant; P < 0.01: Highly significant

Table 2. Comparison between preoperative and 4weeks postoperative central macular thickness

		Preoperative	Postoperative	Paired t-test	
				t	P-value
Central macular thickness (µm)	Mean ± SD	248.35 ± 30.10	271.90 ± 36.49	-3.094	0.006
	Range	194 – 298	202 – 356		

The CMT increased with highly significant degree from (248.35 ± 30.10) preoperative to (271.90 ± 36.49) four weeks postoperatively (p=0.006).

Table 3. Correlation between CMT changes groups and ages of the patients

		<10µm	10-30 µm	>30 µm	
Changes of CMT & Age	Mean ± SD	53.6 ± 6.23	52.58± 8.94	58± 4.08	P-value
	1.000	1.000	1.000	

Table 4. Correlation between postoperative 4weeks CMT with phaco time

		Central macular thickness (µ)	
		r	P-value
Phaco time (min.)		-0.186	0.433

r = Correlation coefficient.

There is no significant correlation between postoperative 4weeks CMT with phaco time as (P> 0.05).

Table 5. Correlation between adrenaline use with 4weeks postoperative CMT

		Adrenaline use		Independent t-test	
		No	Yes	t	P-value
Central Macular thickness (µ)	Mean ± SD	269.83 ± 31.30	275.00 ± 45.36	-0.303	0.766
	Range	202 – 317	226 – 356		

There is no significant correlation between adrenaline use with 4weeks postoperative CMT as (P>0.05).

Table 6. Correlation between U/S phaco type with 4weeks postoperative CMT

		U/S Type		Independent t-test	
		Phaco (longitudinal)	Phaco (Torsional)	t	P-value
Central macular thickness (µ)	Mean ± SD	269.36 ± 43.63	275.00 ± 27.65	-0.335	0.741
	Range	202 – 356	226 – 317		

There is no significant correlation between U/S phaco type with 4weeks postoperative CMT as (P>0.05).

All patients were older than 40 years with cataracts (nuclear II and faint posterior subcapsular) that still permitted almost clear fundal examination.

Methods of ocular examination

- 1. Thorough history taking including:** Age, sex, detailed visual complaints, past ocular history (disease & surgery) and other associated systemic diseases.
- 2. Ocular examination:** Best corrected visual acuity (BCVA) in Snellen's line formatting was done preoperatively and then at 4 weeks. Preoperative anterior segment examination with slit lamp biomicroscopy to assess cataract density. Measurement of intraocular pressure (IOP) with air puff. Preoperative fundus examination with slit lamp biomicroscopy with the +90 D lens to assess macular status and peripheral retina.
- 3. Optical coherence tomography:** Pupils were dilated for OCT examination in all cases with 1% tropicamide (Mydracyl). OCT was done preoperatively and then

4weeks postoperatively. OCT using TOPCON DRI OCT Triton (plus) Swept source OCT, 1050 nm wave length. Retinal thickness was measured with radial lines (16 lines overlap). The scan Diameter is 6.0mm. It consists of two circular maps divided into nine areas centered on macula of each eye. Only mean foveal thickness was studied; which represents the mean thickness of a foveal area of a diameter of 1000 µm (1mm).

Inclusion criteria: Any degree of cataract, agemore than 40years and macula free clinically and by OCT.

Exclusion criteria include: Diabetic patients, hypertensive patients, glaucomatous patients and uveitic patients.

Phacoemulsification procedure: Phacoemulsification and intraocular lens insertion were performed using almost the standard techniques. Before surgery, all pupils were dilated with 1% tropicamide (Mydracyl), also ocular sterilization with povidine iodine 5% was used. Cataract surgery was performed under local anaesthesia, anterior limbal scratch incision was

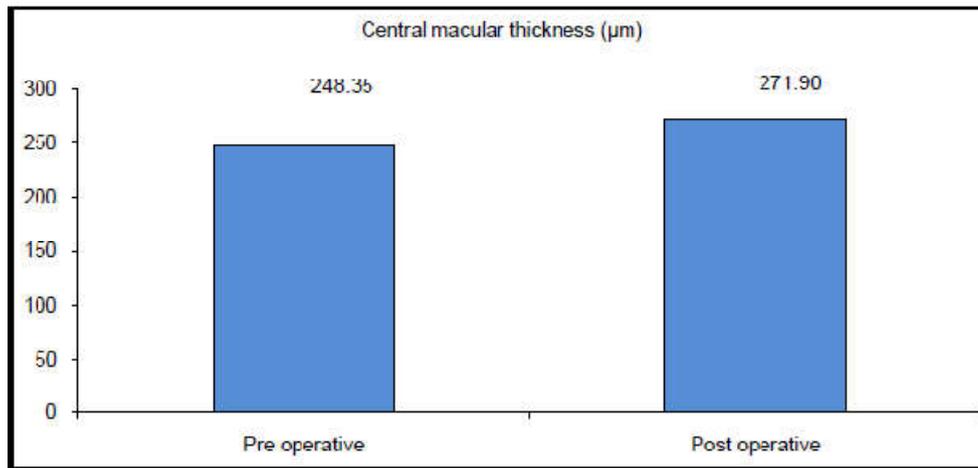
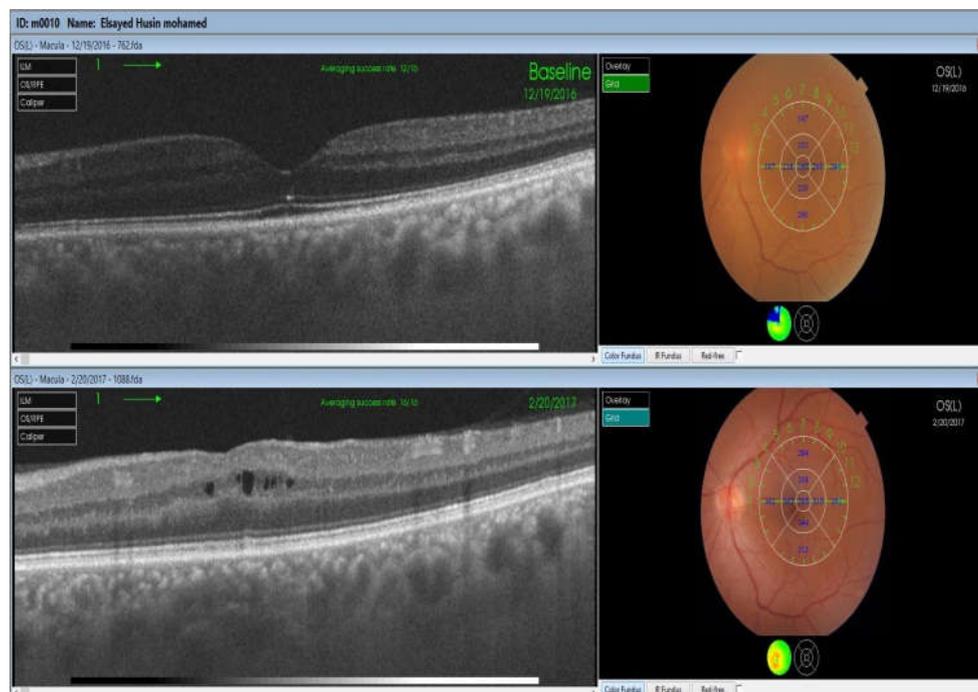


Fig. 1. Column chart showing CMT changes



There is no significant correlation between postoperatively macular changes and ages of the patients as ($P=1.000$).

Fig. 2. Preoperative and four weeks postoperative OCT with CME

made using keratome, two side ports was made by micro vitreo-retinal plade (MVR). Use of epinephrine solution with eight patients. Formation of the anterior chamber by viscoelastic material. Capsulorhexis was performed under viscoelastic material. Hydrodissection and hydrodelineation. Phacoemulsification of the nucleus. Computing of phaco time. Bimanual irrigation aspiration. Implantation of foldable intraocular lens in the bag by injector through the wound. Finally hydration of the wound and the 2 paracentesisopenings. After the operation all patients received the same standard medication, consisting of a combination of steroidal eye drops (Prednisolone acetate), 1 drop every 6 hours for 1 week, then 1 drop every 8 hours for 2 weeks, then 1 drop every 24 hours for 1 week and antibiotic (Gatifloxacin) eye drops 4 times daily for 10 days.

Follow up

Clinical examination at one week and one month postoperatively including best corrected visual acuity and fundus examination. OCT was done at 4 weeks postoperatively.

RESULTS

This study was conducted on 20 eyes of 15 non-diabetic more than 40 years old subjects who underwent uneventful phacoemulsification and posterior chamber foldable IOL implantation. The mean age was 53.65 ± 8.20 . They were 8 females and 12 males. The following table No. (1) is showing comparison between preoperative, 1 week and 4 weeks postoperative BCVA. The BCVA increased with highly significant degree from 0.67 ± 0.21 on logMAR to 0.38 ± 0.23 one week postoperatively and 0.24 ± 0.23 four weeks postoperatively ($p=0.000$). Central macular thickness (CMT), which represents area of a diameter of $1000 \mu\text{m}$ (1mm), was studied preoperative and four weeks postoperative using OCT. The following photo Fig. No. (2) is showing cystoid macular edema (CME) of a patient of this study which represents 5% of total study cases. The following Table No. (5) shows correlation between intraoperative adrenaline use (intracameral epinephrine) with 4 weeks postoperative CMT. The following Table No. (6) Shows correlation between U/S phaco type with 4 weeks postoperative CMT.

DISCUSSION

Phaco is currently the most commonly used technique to remove the cataract lens using ultrasonic energy. Many studies have shown that phaco provides satisfactory outcomes for patients and is a safe surgery. Phaco related changes in foveal thickness have also been reported (Mohamed, 2014). The incidence of subclinical macular edema after uneventful cataract surgery has become a safety issue for this frequent operation, as studies have found angiographic leakage up to 19% postoperatively with OCT, which its peak is detectable 4 to 6 weeks after surgery, in pseudophakic eyes (Gabriel *et al.*, 2010). In present study, the investigation of the effect of phacoemulsification on central macular thickness was measured by swept source OCT, and the results indicate that there is highly significant increase in thickness from $248.35 \pm 30.10 \mu\text{m}$ preoperative to $271.90 \pm 36.49 \mu\text{m}$ at four weeks after cataract surgery. Although present study included a small group (only 20 eyes), it is assumed that data reliability is high because of the homogeneous nature of the patients (similarities of age, cataract type and severity, phaco time and so on) and the careful/detailed OCT examinations performed by one investigator. Torkey²⁰ evaluated the effect of phacoemulsification on central macular thickness and her sample group was on 25 eyes and the result was a highly significant increase in thickness from 208.7 ± 41.0 preoperatively to 232.9 ± 35.6 4weeks postoperative. Present results support the recent studies by Altintas, et al² and Celik, et al⁵ which reported significant increases in CMT after uneventful phacoemulsification. But Protasio & Aguilar¹⁶ showed that there was a mean change in CMT $1.8 \pm 8.8 \mu\text{m}$ ($p=0.44$) which is not significant, which is on the contrary of this study which may be due to race difference because that study was carried out in Philippine. The ages of the patients were not significantly correlated to changes in CMT. Also, Gharbiya, *et al.* 1953 and Torkey had no statistically significant result between ages of the patients and changes in CMT. In present study the only patient who had developed CME in his second operated eye may be due to hypersensitivity from lens material sensitization due to phaco manipulation during his first eye surgery 27 days before, but it is still a weak probability as other four patients in this study made also their second eye after the first eye by variety from 14-48 days and had not developed CME. The BCVA improvement was highly significant from 0.67 ± 0.21 on log MAR to 0.38 ± 0.23 at one week postoperatively and to 0.24 ± 0.23 at four weeks postoperatively ($p\text{-value} = 0.000$). Also, Akçay, et al¹ & Mohamed¹⁴ showed that BCVA was improved significantly after one week postoperatively. Also Akçay *et al.* 2012; Nagy *et al.* 2016 and Celik *et al.* 2010 Showed that BCVA was improved significantly after four weeks postoperatively. The mean phaco time in present study was (1.43 ± 0.23 min) and there is no significant correlation between postoperative 4weeks CMT statistically ($P > 0.05$). Surbhi *et al.* 2012; Gharbiya *et al.* 1953, Koç *et al.* 2014 and Altintas *et al.* 2016 Showed that no significant correlation was found between 4weeks postoperative CMT measurement and phaco time (PT). There was no significant correlation between adrenaline use with 4 weeks postoperative CMT ($P > 0.05$). Also Johansson *et al.* 2016 and Bozkurt *et al.* 2016 had no statistically significant result between adrenaline use and 4 weeks postoperative CMT. Regarding U/S phaco type and 4weeks postoperative CMT neither torsional nor longitudinal types had significant correlation between U/S phaco type with

4weeks postoperative CMT ($P > 0.05$), Surbhi *et al.* 2012 also reached to the same conclusion.

REFERENCES

- Akçay B.I., Bozkurt T.K., Güney E., et al. 2012. Quantitative analysis of macular thickness following uneventful and complicated cataract surgery, *Clinical Ophthalmology*, 6: 1507–1511.
- Altintas A.G., Coban P., Arifoglu H.B., et al. 2016. Comparison of phacoemulsification parameters effect on macular thickness changes after uneventful phacoemulsification in diabetic and non – diabetic patients, *Int Eye Sci.*, 16(2): 201-206.
- Annie C., Jay S.D., Tony H.K., et al. 2006. Normal Macular Thickness Measurements in Healthy Eyes Using Stratus Optical Coherence Tomography, *Arch Ophthalmol.*, 2: 193-198.
- Bozkurt E., Yazici A.T., Pekel G., et al. 2010. Effect of intracameral epinephrine use on macular thickness after uneventful phacoemulsification, *J Cataract Refract Surg.*, 36(8): 1380-1384.
- Celik E., Cakır B., Turkoglu E.B., et al. 2016. Effect of cataract surgery on subfoveal choroidal and ganglion cell complex thicknesses measured by enhanced depth imaging optical coherence tomography, *Clinical Ophthalmology*, 10: 2171–2177.
- Cosca G., Cunha-Vaz J. and Soubrane G. 2010. Macular edema: definition and basic concepts, *Dev Ophthalmol.*, 47: 1-9.
- David R.L. and Chirag P.S. 2014. Pseudophakic Cystoid Macular Edema, *Review of Ophthalmology*, 1-3.
- Ecsedy M., Miháلتz K., Kovács, I. et al. 2011. Macular Effects After Femtosecond Laser Cataract Surgery, *Journal of Refractive Surgery*, 27(10): 717-722.
- Gabriel C., José C.V., Anat L., et al., 2010. Macular Edema : General Pathophysiology In : Macular Edema A Practical Approach. Published by Karger, 1st edition. Switzerland, 2: 10-26.
- Gharbiya M., Cruciani F., Cuozzo G., et al. 2013. Macular thickness changes evaluated with spectral domain optical coherence tomography after uncomplicated phacoemulsification, *Eye*, 27(5) :605–611.
- Irvine S.R. 1953. A newly defined vitreous syndrome following cataract surgery, *Am J Ophthalmol.*, 36 :599-619.
- Johansson M.; Lundberg B. and Behndig A. 2007. Optical coherent tomography evaluation of macular edema after phacoemulsification surgery with intracameral mydriatics, *J Cataract Refract Surg.*, 33(8) : 1436-1441.
- Koç H., Koçak I., Kaya F., et al. 2016. Effect of Phaco Time on Retinal Thickness, *American Journal of Ophthalmology & Visual Science*, 1(1): 1-5.
- Mohamed Kh. M. 2014. Anterior Chamber Fluctuation and Its Effect on Macular Thickness in Uncomplicated Phacoemulsification, *J Am Sci.*, 10(8):248-251.
- Nagy Z.Z.; Ecsedy M., Kovacs I., et al. 2012 Macular morphology assessed by optical coherence tomography image segmentation after femtosecond laser-assisted and standard cataract surgery, *J Cataract Refract Surg.*, 38: 941–946.
- Protasio J.N. and Aguilar R.N. 2016. Glycemic Control and Changes in Macular Thickness after Phacoemulsification in Diabetics, *Journal of ophthalmology*, 41: 2-9.
- Rotsos T.G. and Moschos M.M.(2008).Cystoid macular edema, *Clin Ophthalmol.*, 2(4): 919–930.

Scholl S.; Augustin A., Loewenstein A., et al (2011) : General pathophysiology of macular edema, *Eur J Ophthalmol.*, 21(6) : 9-10.

Surbhi A., Uma S., Charu, T. et al. 2012. To Determine the Incidence of CME after Uneventful Phacoemulsification by OCT, *WOC2012 Abstract Book*, 123(10): 146- 149.

Torky Z.A. 2012. Evaluation of macular changes after uneventful phacoemulsification surgery in diabetic patients using optical coherence tomography, *Ophthalmology department, Faculty of medicine, Cairo University, Cairo, Egypt*, 2: 5-88.
