Evaluation of Central Macular Thickness Changes after Uncomplicated Phacoemulsification in Diabetic Patients

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Abstract: Purpose of the study: To study the changes that occur after uncomplicated phacoemulsification on central macular thickness in diabetic and non diabetic patients and its effect on visual outcome by comparing the results of both. **Patients and Methods:** Fifty eyes for 47 patients were included in this study divided into two groups. Group 1 includes 25 eyes for 22 diabetic patients and Group 2 includes 25 eyes for 25 non diabetic patients, all eyes underwent phacoemulsification. Central macular thickness measured preoperative and one week postoperative for all patients, also visual acuity and fundus assessed preoperative and one week postoperative. **Results:** There was no significant difference *(P*= 0.0134) between two groups regarding preoperative central macular thickness. in group (1) CMT. 201.84±2.02μm and group (2) was 193.4 ± 2.49μm while postoperative central macular thickness in group (1) 215.72± 3.4 μm while in group (2) 199.7± 2.4 μm and P value was highly significant where *P*=0.0003. **Conclusion:** The study shows that postoperative central macular thickness increases in non diabetic patients after uncomplicated phacoemulsification but in small percentage and never reach to CSME while in diabetic patients the percentage more than non diabetic and the thickness also more specially in patients with diabetic maculopathy preoperative.

[Mohamed Khedr M. **Evaluation of Central Macular Thickness Changes after Uncomplicated Phacoemulsification in Diabetic Patients.** *J Am Sci* 2014;10(10):153-156]. (ISSN: 1545-1003). http://www.jofamericanscience.org. 23

Keywords: clinically significant macular edema; maculae thickness; phacoemulsification; optical coherence tomography.

1. Introduction

Phacoemulsification is one of the most widely used cataract surgery techniques now a day. Various factors involved in phacoemulsification can influence the tissue structures of the eye ball (1). Unlike other maneuvers, ultrasonic energy and fluidics produce mechanical effect that cause inflammatory reaction (2).

Cystoid macular edema (CME) is the formation of fluid –filled spaces between the outer plexiform and inner nuclear layers of the retina, resulting from disruption of blood retinal barrier (3)

It is a common complications observed after cataract surgery, with or without other complications. The rate of cystoid macular edema increases in the presence of diabetic retinopathy and uveitis. Although the pathogenesis is still not fully understood the diagnosis is usually confirmed by clinical or angiographic examination, with modern surgical techniques the incidence of (CME) has been decreased (4).

The pathogenesis of ME is associated with the destruction of blood aqueous barrier and the blood retinal barrier induced by prostaglandins or other inflammatory mediators (5).

Elevated levels of angiogenic factors, inflammatory cytokines, chemokines, and growth factors in the aqueous humor may play a role in the breakdown of the vascular barrier (6).

Diabetes has been associated with an increased incidence of postoperative macular edema. The incidence of macular edema on optical coherence tomography (OCT) was 22% in diabetic eyes undergoing cataract surgery (7).

OCT has been shown to be highly reproducible in measuring macular thickness in normal individuals and diabetic patients (8). For detecting macular edema, 0CT is superior to contact lens biomicroscopy and as effective as fluorescein angiography (9).

2. Patients and methods

This prospective study includes Fifty eyes for 47 patients, divided into two groups. Group 1 include 25 eyes for 22 diabetic patients and Group 2 includes 25 eyes for 25 non diabetic patients. All patients included in this study were underwent preoperative ophthalmological examination which include, best corrected visual acuity on decimal charts was converted to the logarithm of minimal angle of resolution (log MAR) scale for statistical analysis preoperative and one week postoperative, slit lamp-assisted biomicroscopy of anterior and posterior segment to detect stage of diabetic retinopathy and detect grade of macular edema if present under fully dilated pupil preoperative and one week postoperative

Optical coherence tomography to measure central macular thickness preoperative and one week postoperative was performed by experienced operator through a dilated pupil where six radial scans centered on the fovea yielding a total of 600 samples from six radial scans.

Exclusion criteria: exclude patients with dense cataract does not permits to measure the central macular thickness, cases with proliferative diabetic retinopathy, patients with chronic uveitis or any posterior segment pathology rather than non proliferative diabetic retinopathy. Patients with intraoperative complications were excluded from the study like posterior capsule rupture with or without vitreous loss or dropped nucleus or nuclear fragments, iris trauma and postoperative inflammation or corneal edema.

Surgical procedures

All surgeries were performed by one surgeon, clear corneal incision by metal keratome 2.8 mm was

made and side ports by angled MVR 20 gauge, continuous curvilinear capsulorhexis measuring approximately 6 mm started with bent insulin needle and completed with capsulorhexis forceps,hydro dissection and hydrodelination of the nucleus. Phacoemulsification done successfully for all patients mainly Divide and Conquer, stop and chop, techniques were the main techniques of phacoemulsification used. Automated bimanual irrigation aspiration of cortical matter after removal of all nuclear quadrants was used, the capsular bag was inflated with 1% sodium hyaluronate, after which the acrylic intraocular lens injected in the bag through 2.8 mm incision. Hydration of the main incision and then removal of viscoelastic by automated I/A cannulas, then hydration of the side ports, lastly subconjunctival injection of garamycin, dexamethasone and eye patch applied.

3. Results

Fifty eyes for forty seven patients were included in this study they are divided into two groups. Group (1) include twenty five eyes for twenty two diabetic patients, females were 14 represent 63.7% of total number and males were 8 represent 36.3% of total number of the group 1. Their range of age were 43 -62 years, mean of age 51.7± 1.29 and average duration of diabetes were 8.27 ± 0.8 years.

Group (2) include 25 eyes for 25 non diabetic patients 16 females and 9 males represent 64% and 36% respectively, the mean of age were 44.3 ± 1.8 years, and age range was 27-59 as shown in table 1

Regarding visual acuity preoperative and postoperative in both groups shows that in group (1) mean preoperative visual acuity was 0.12 ±0.013 while in group (2) was 0.15±0.016 and P= 0.1487.

Post operative mean visual acuity of group (1) was 0.79± 0.03 while mean post operative visual acuity of group (2) was 0.87± 0.02 and p=0.069 as shown in table 2.

Table (1) show demography of the studied groups.

Item	Group 1	Group 2
Total number	22	25
Male - %	8 - 36.6%	9 - 36%
Female - %	14- 63.7%	16- 64%
Range of age	43-62 years	27-59 years
Mean of age	51.7± 1.29	44.3 ± 1.8
±St.D	6.1	9.3
*P.*value	0.002	
Average duration of diabetes	8.27±0.8 years	----------

Table 2 shows visual acuity pre- and post- operative in both groups.

Item	Group 1	Group 2
Mean preoperative V.A	0.12 ± 0.013	0.15 ± 0.016
±St.d	0.06	0.08
P. value	0.1487	
Mean post operative V.A	0.79 ± 0.03	0.87 ± 0.02
±St.d.	0.16	0.1
P. value	0.069	

Regarding central macular thickness preoperative in both groups. In group (1) mean central macular thickness were 201.72 ± 2.02µm, while in group (2) mean preoperative central macular thickness were 193.4 ± 2.49 µm and *P*= 0.0134 of no significance. Statistical analysis of postoperative central macular thickness of both groups shows mean central macular thickness of group (1) were 215.72±3.4 and mean CMT of group (2) were 199.7±2.4µm and *P* =0.0003 as shown in table (3)

Table (3) comparing preoperative and postoperative central macular thickness of both groups.

Item	Group 1	Group 2
Mean preoperative CMT	201.84±2.02µm	193.4 ±2.49µm
±St.D.	10.69	12.47
P Value	0.0134	
Mean postoperative CMT	215.72 ± 3.4µm	199.7 ±2.4µm
±St.D.	16.9	12.2
*P.*Value	0.0003	

By comparing the results of preoperative central macular thickness and postoperative of the same group we found that in group (1) mean post operative CMT 215.72 ± 3.4µm with highly significant

P= 0.0005.

While in group (2) mean postoperative CMT were 198.8 ± 2.35µm statistical analysis of results of group 2 show *P*= 0.12 of no significance.

Statistical analysis of preoperative central macular thickness of the same group in group (1) *p*=0.0011 while in group (2) *P*=0.121 as shown in table (4)

By comparing preoperative and postoperative central macular thickness of group (1) we found that 5 cases shows marked increase in central macular thickness but not exceed 30% of preoperative measure they are represent 20% as shown in Figures 1, 2 (a) and (b). while in group 2 only three cases show little difference represent 12% of total cases, with no cases exceed 30% of preoperative central macular thickness as shown in Figures 3,4,(a) and (b).

Table 4 shows comparison of preoperative and post operative central macular thickness of each group.

Item	Preoperative CMT.	Postoperative CMT
Group1		
Mean CMT.	201.84 2.13µm	215.72 3.39µm
±St.D.	10.69	16.98
P.V	0.0011	
Group 2		
Mean CMT	193.4 2.49µm	198.8 2.35µm
±St.D	12.47	11.75
P.V.	0.121	

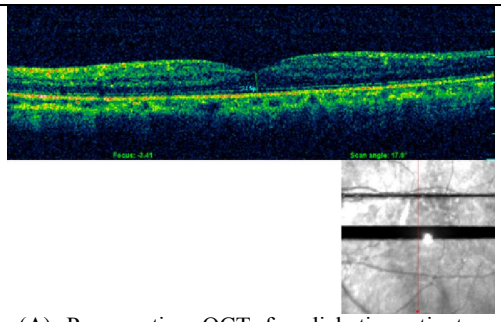

Fig.1 (A) Preoperative OCT for diabetic patient central macular thickness 215 µm.

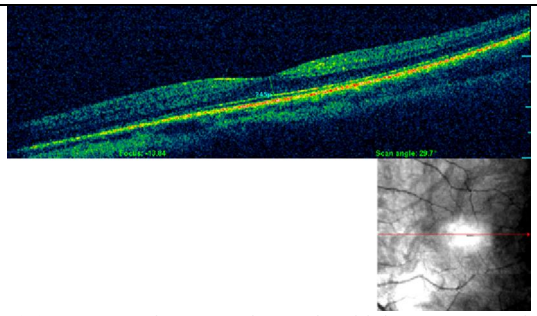

Fig. 1 (B) postoperative central macular thickness 245µm for the same patient

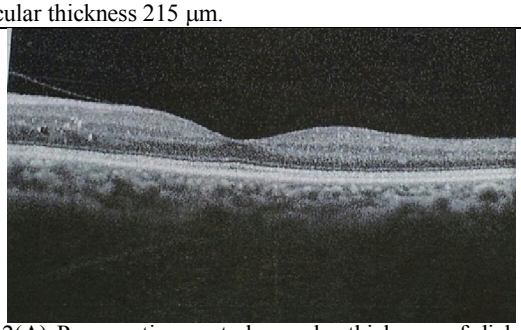

Fig.2(A) Preoperative central macular thickness of diabetic patient 220 µm. with diabetic maculopathy

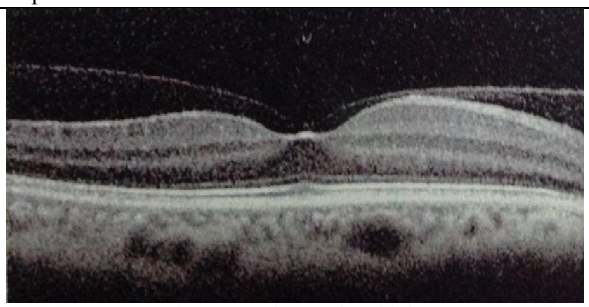

Fig 2 (B) Postoperative central macular thickness 247µm for the same patient

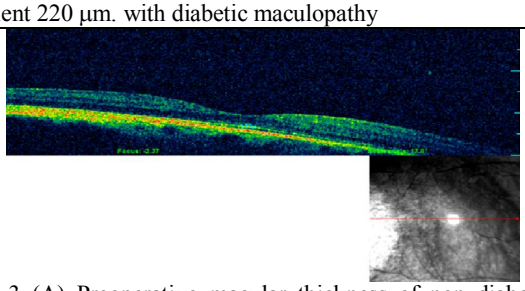

Fig 3 (A) Preoperative macular thickness of non diabetic patient 175 µm

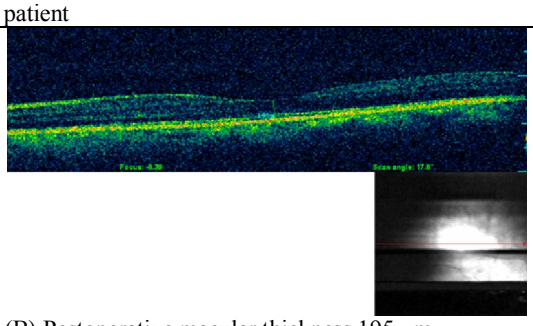

Fig.3 (B) Postoperative macular thickness 195 µm

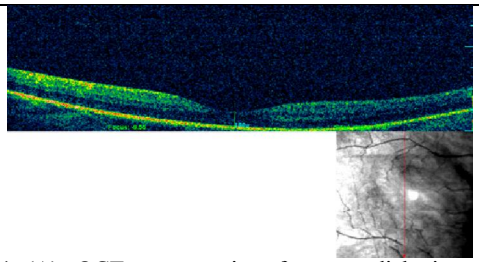

Fig. 4 (A) OCT preoperative for non diabetic patient macular thickness 180 µm

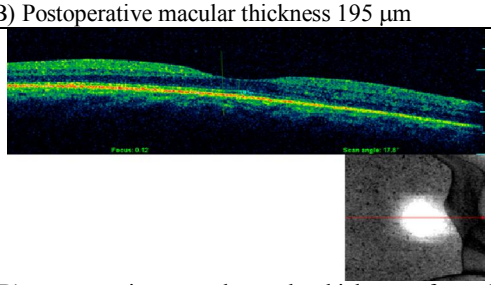

Fig. 4 (B) postoperative central macular thickness of non diabetic patient 185µm

Discussion

This study have shown that the central macular thickness in diabetic patients after uncomplicated phacoemulsification increases more than in non diabetics, 20% of diabetic patient show increase in central macular thickness and 12% of non diabetic patients. This may be explained that. it is thought that psudophakic macular edema is caused by cytokines including prostaglandin or vascular endothelial growth factor, which are released from blood- ocular barrier after cataract surgery.

Breakdown of blood – ocular barrier in diabetic eyes, particularly in eyes with diabetic retinopathy is known to be greater than that of non diabetic eyes (10).

Mean visual acuity improved significantly after uncomplicated phacoemulsification in eyes with and without diabetes, and did not worsen even in patients with increased central macular thickness, the improvement of visual acuity postoperative in non diabetic group is much better than diabetic group but statistically non significant.

Previous studies showed that diabetic macular edema progressed in approximately 20-40 %of eyes that underwent cataract surgery but, in considerable percentage of these eyes, the macular edema resolve spontaneously either temporarily like Irvin-gas syndrome or substantial progression of diabetic maculopathy (11).

Funtasu *et al.*- reported the amount of vascular endothelial growth factor in the aqueous humor to be a significant predictor for progression of macular edema (12).

This study have shown that postoperative increase in central macular thickness more prominent in diabetic patient that already have higher central macular thickness (diabetic maculopathy) preoperative more than patients that had normal central macular thickness, while non diabetic patient have very low incidence of increased central macular thickness postoperative.

Conclusion

Changes in central macular thickness occur after uncomplicated phacoemulsification either in diabetic or non diabetic, rate and range of increased central macular thickness is more in diabetic specially patients already have diabetic maculopathy or high central macular thickness preoperative.

The subject need more investigation by increasing number of cases and follow up for long period also search for prevention of deterioration of macular edema specially after phacoemulsification specially patients that already have diabetic maculopathy

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9/10/2014