European Journal of Molecular & Clinical Medicine

ISSN 2515-8260 Volume 10, Issue 2, Winter 2023

ORIGINAL RESEARCH

Evaluation of effect of phacoemulsification on central macular thickness and best corrected visual acuity in patients of diabetes mellitus

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Received: 18 December, 2022 Accepted: 24 January, 2023

ABSTRACT

Background: To evaluate the effect of uncomplicated phacoemulsification on central macular thickness (CMT) and best corrected visual acuity (BCVA) in diabetic patients without diabetic retinopathy (DR) and diabetic patients with mild to moderate non proliferative diabetic retinopathy (NPDR).

Materials & methods: A total of 200 diabetic patients (200 eyes) who underwent phacoemulsification were divided into 2 groups as Group A:100 patients withoutDR and Group B:100 patients with mild to moderate NPDR. All patients entered into the study were followed up preoperatively and at 1 month, 6 months and 1 year after phacoemulsification and CMT and BCVA were evaluated at each follow up and tabulated and analyzed by suitable statistical tests.

Results: CMT of group A at postoperative 1 month and 6 months was 259.20±20.57µm and 243.48±11.11µm respectively and of group B was 280.03±34.52µm and 254.28±16.46µm respectively. There was significant difference between 2 groups at both postoperative 1 month and 6 months after uncomplicated phacoemulsification. There was no significant difference in the postoperative mean CMT at 1 year between group A (234.03±9.38µm) and group B (240.21±34.00 µm). Mean BCVA Log MAR was 0.15±0.22 in group A as compared to 0.30±0.34 in group B at postoperative 1 month, mean BCVA Log MAR was 0.13±0.12 in group A as compared to 0.20±0.20 in group B at postoperative 6 months, mean BCVA Log MAR was 0.11±0.11 in group A as compared to 0.17±0.15 in group B at postoperative 1 year. 'p'-value was highly significant in the mean BCVA Log MAR at postoperative at 1 month,6 months and 1 year between the two groups.

Conclusion: There was significant increase in mean CMT and mean BCVA Log MAR at postoperative 1 month,6 months and 1 year in both the groups. At postoperative 1 and 6 months there was significant difference in CMT between both groups whereas there was no significant difference in CMT at 1 year between the 2 groups. At postoperative 1 month, 6 months and 1 year, there was significant difference in BCVA Log MAR between both groups.

Keywords: Diabetic retinopathy, Central macular thickness, phacoemulsification.

INTRODUCTION

Diabetes mellitus (DM) is a worldwide public health problem that affects millions of people from all age, gender, and racial and ethnic groups. [1] Diabetic retinopathy (DR) is a common microvascular complication associated with diabetes and encompasses a broad clinical spectrum from the mild non-proliferative DR (NPDR) to a more advanced stage of vision-threatening such as proliferative DR (PDR). [2] Pathophysiology of diabetic retinopathy revolves around the integration between neurovascular unit.[3]In early stages of diabetic retinopathy, patient is asymptomatic and as the disease progresses, patient may develop symptoms like blurred vision, floaters, fluctuating vision, dark areas in the vision, poor night vision, impaired colour vision and partial or total loss of vision.[4]

There is increased risk of cystoid macular edema after cataract surgery in diabetic patients especially in patients with pre-existing diabetic retinopathy.[5] The reported incidence of ME ranges from 20% to 50% in patients with diabetes following uncomplicated phacoemulsification cataract surgery.[6]Macular oedema is the accumulation of extracellular fluid in the central retina (the macula) which may present following cataract surgery with lens implantation (pseudophakic macular oedema) or without lens implantation (aphakic macular oedema) and may give rise to poor visual outcome with reduced visual acuity and distortion of the central vision.[7]The pathogenesis of CME (cystoid macular edema) following cataract surgery is multifactorial which includes functional disturbance of the blood-retinal barrier (BRB) and inflammation mediated by prostaglandins, cytokines and other vascular permeability factors.[5]Increased aqueous levels of IL-1β, IL-6, IL-8, IP-10, MCP-1, and VEGF are observed during cataract surgery in patients with non-proliferative diabetic retinopathy.[6]VEGF is a key mediator of angiogenesis, but it also plays an important role in the inflammation and capillary permeability that causes CME.[8]

Optical coherence tomography (OCT) is a noninvasive, non-contact transpupillary imaging technique that allows cross sectional images of retina to be taken. It is based on the principle of interferometry which uses light and measures the echo delay time of the light reflected and backscattered from retina.[9]OCT evaluation of cystoid macular edema shows macular thickening and cystic spaces in the inner nuclear layer and the outer plexiform layer.[10]

Hence, this study was conducted to observe the macular OCT findings and best corrected visual acuity (BCVA) following phacoemulsification with respect to diabetic retinopathy.

MATERIALS & METHODS

A total of 200 diabetic patients (200 eyes) who underwent phacoemulsification were divided into 2 groups: Group A: 100 diabetic patients without diabetic retinopathy (DR) and Group B:100 diabetic patients with mild to moderate non proliferative diabetic retinopathy (NPDR). Patients with type 2 diabetes mellitus who were diagnosed with immature cataract and underwent phacoemulsification with posterior chamber intraocular implantation were included. A detailed history of the patient was taken. A detailed examination of both the eyes of each patient was done. Evaluation of fasting serum glucose level and blood pressure was done. Optical coherence tomography (OCT) of each eye was done in dilated pupils to see the macular status. All patients entered into the study were followed up preoperatively and at 1 month, 6 months and 1 year after phacoemulsification and Central macular thickness (CMT) and best corrected postoperative visual acuity (BCVA) was evaluated at each follow up and tabulated and analyzed by suitable statistical tests. Statistical analysis was done using statistics software SPSS 26. Pearson's chi-squared test was used. ANOVA analysis were used to differentiate means among the two or more groups.

RESULTS

The present study was conducted on 200 diabetic patients with or without mild to moderate diabetic retinopathy.

Table 1: Mean central macular thickness (cmt) preoperatively and postoperatively (1 month, 6 months and 1 year) in group a

Central Macular Thickness (CMT) in µm	N	Mean± S.D.	'p' value
Preoperative	100	229.60±5.16	0.000
Postoperative 1 month	100	259.20±20.57	
Preoperative	100	229.60±5.16	0.000
Postoperative 6 month	100	243.48±11.11	
Preoperative	100	229.60±5.16	0.000
Postoperative 1 Year	100	234.03±9.38	

There was significant increase in mean CMT from 229.60±5.16 µm preoperatively to 259.20±20.57 µm at 1 month, 243.48±11.11 µm at 6 months and 234.03±9.38 µm at 1 year postoperatively. (p-value=0.000)

Graph 1: Mean central macular thickness (cmt) preoperatively and postoperatively (1 month, 6 months and 1 year) in group a

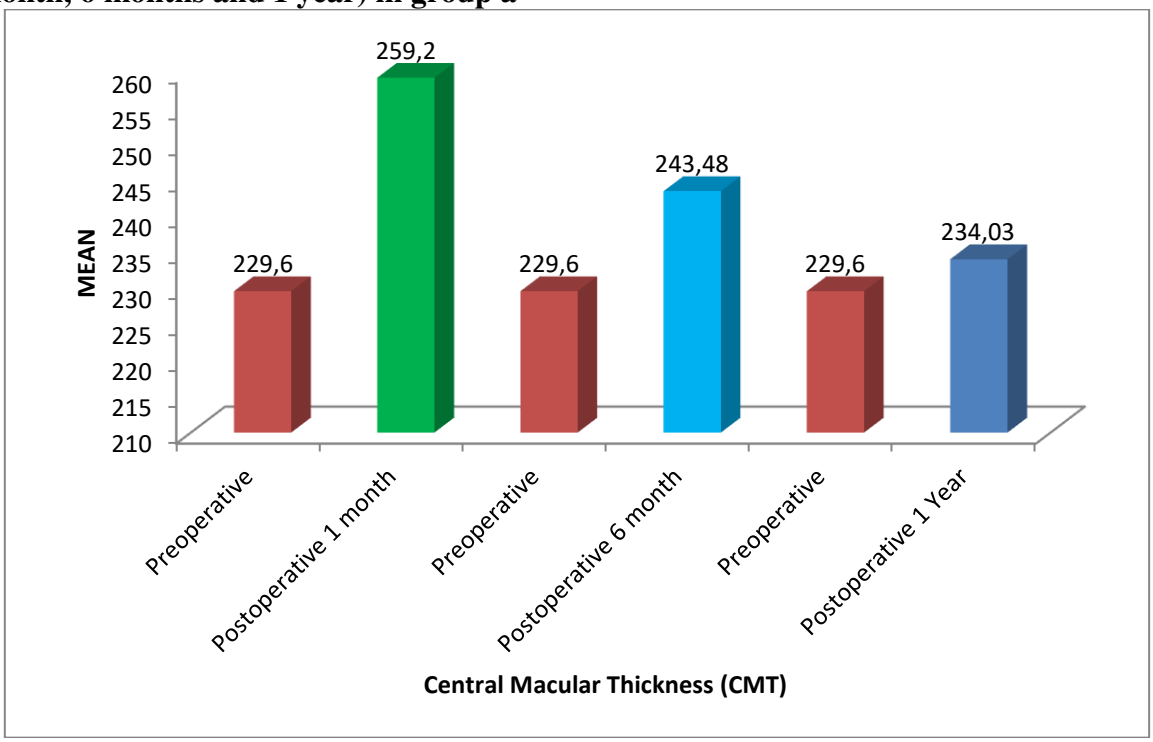


Table 2: Mean central macular thickness (cmt) preoperatively and postoperatively (1 month, 6 months and 1 year) in group b

Central Macular Thickness (CMT) in µm	N	Mean± S.D.	'p' value
Preoperative	100	232.58±5.06	0.000
Postoperative 1 month	100	280.03±34.52	
Preoperative	100	232.58±5.06	0.000
Postoperative 6 month	100	254.28±16.46	
Preoperative	100	232.58±5.06	0.027
Postoperative 1 Year	100	240.21±34.00	

In group B, there was significant increase in mean CMT from 232.58±5.06 µmpreoperatively to 280.03±34.52 µmat 1 month, 254.28±16.46 µmat 6 months and 240.21±34.00 µmat 1 year postoperatively (p value<0.05).

Graph 2: Mean central macular thickness (cmt) preoperatively and postoperatively (1 month, 6 months and 1 year) in group b

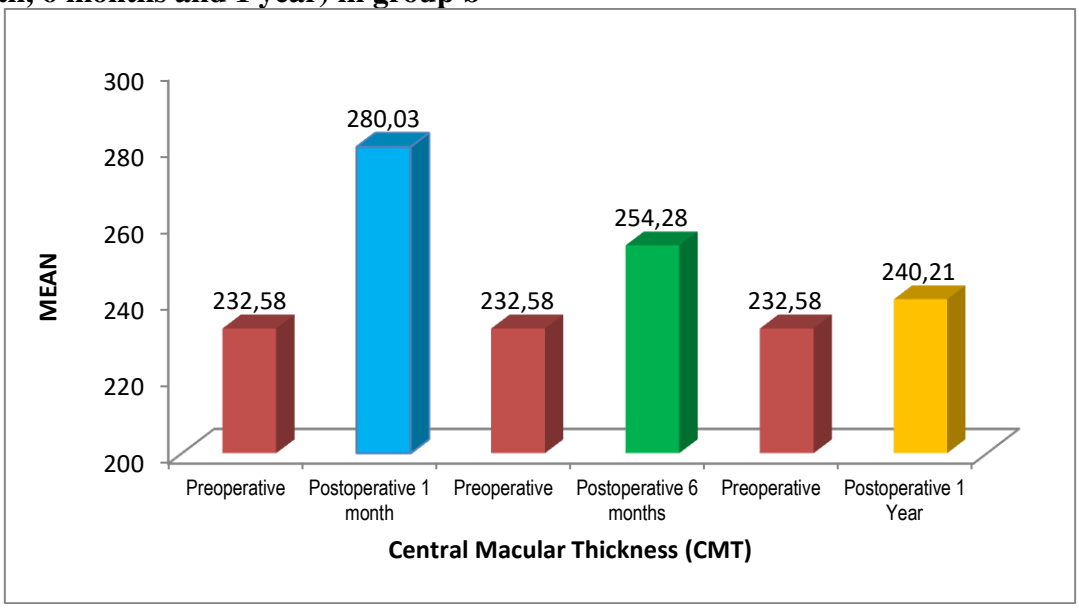


Table 3: Mean central macular thickness of group A and B preoperatively and postoperatively (1 month, 6 months and 1 year)

CMTin µm	Preoperative (Mean±S.D.)	Postoperative		
		1 month (Mean±S.D.)	6 months (Mean±S.D.)	1 year (Mean±S.D.)
Group A (No Diabetic Retinopathy)	229.60±5.16	259.20±20.57	243.48±11.11	234.03±9.38
Group B (Mild to Moderate NPDR)	232.58±5.06	280.03±34.52	254.28±16.46	240.21±34.00
'p' value	0.000^{HS}	0.000 ^{HS}	0.000^{HS}	0.081^{NS}

NS=Not significant ('p'>0.05); S=Significant (p<0.05); HS= Highly Significant (p<0.001)

Mean CMT in group A and group B preoperatively was 229.60±5.16 µm and 232.58±5.06 µm respectively. There was significant difference in mean CMT between 2 groups preoperatively (p-value=0.00). CMT at postoperative 1 month and 6 months of group A was 259.20±20.57µm and 243.48±11.11µm respectively and of group B was 280.03±34.52µm and 254.28±16.46µm respectively. There was significant difference between 2 groups at both postoperative 1 month and 6 months after uncomplicated phacoemulsification (p-value=0.00). Mean CMT in group A and group B at 12 months after uncomplicated phacoemulsification was 234.03±9.38 µm and 240.21±34.00 µm respectively. There was no significant difference in mean CMT between 2 groups at 12 months (p- value=0.08).

Graph 3: Mean central macular thickness of group a and b preoperatively and postoperatively (1 month, 6 months and 1 year)

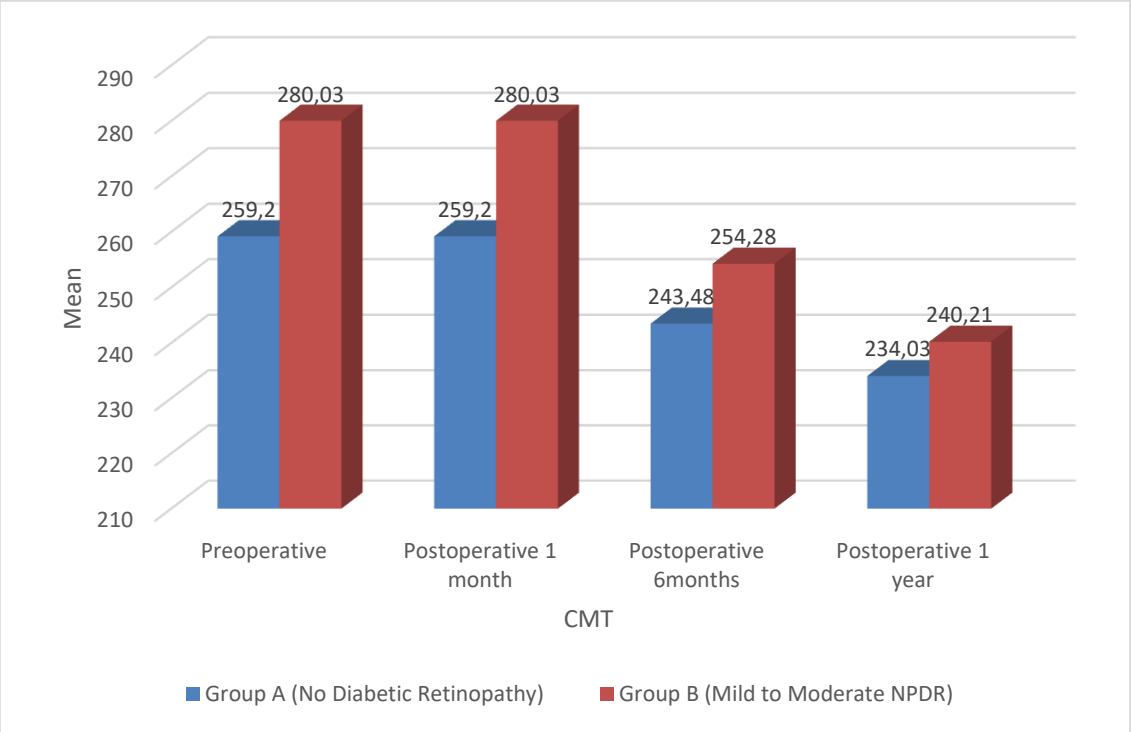


Table 4: Postoperative macular edema in group A and group B

Macular oedema (CMT> 30% of pre-operative value)	Postoperative		
	1 month [No. of cases(%age)]	6months [No. of cases(%age)]	1 year [No. of cases(%age)]
Group A (No Diabetic Retinopathy)	11 (11.0%)	4 (4.0%)	2 (2.0%)
Group B (Mild to moderate NPDR)	30 (30.0%)	10 (10.0%)	7 (7.0%)

In group A,11% cases developed macular edema (CMT> 30% of pre-operative value) at postoperative 1 month, out of which 63.6% cases resolved resulting in 4% cases at postoperative 6 months and 81.8% resolved at 1 year resulting in 2% cases in which macular oedema was diminished but not resolved.

In group B,30% cases developed macular edema (CMT> 30% of pre-operative value) at postoperative 1 month, out of which 66.6% cases resolved resulting in 10% cases at postoperative 6 months and 76.6% resolved at 1 year resulting in 7% cases in which macular oedema was diminished but not resolved.

Graph 4: Postoperative macular edema in group a and group b

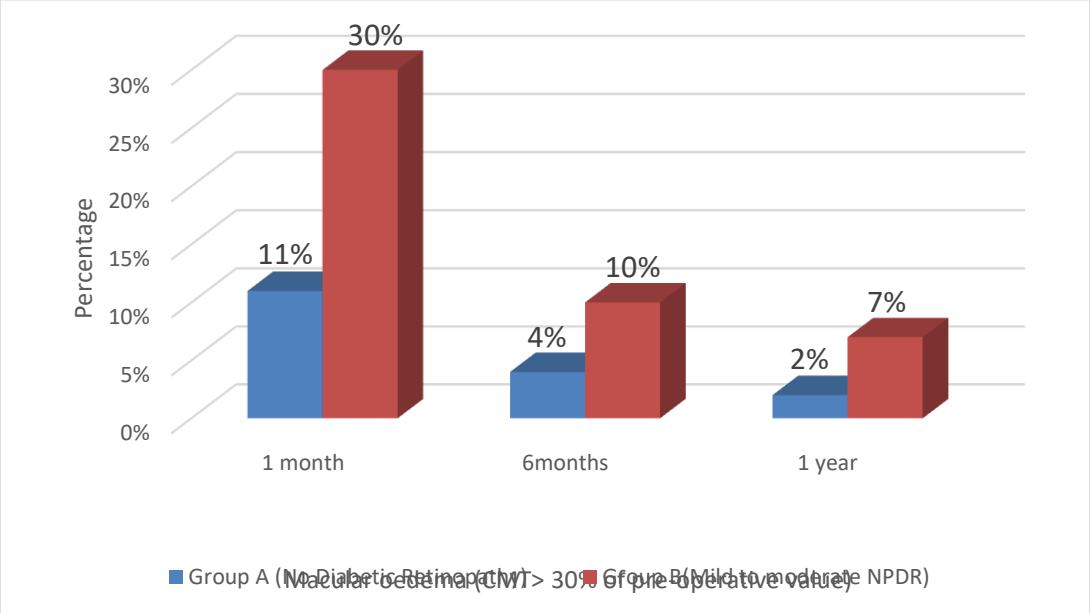


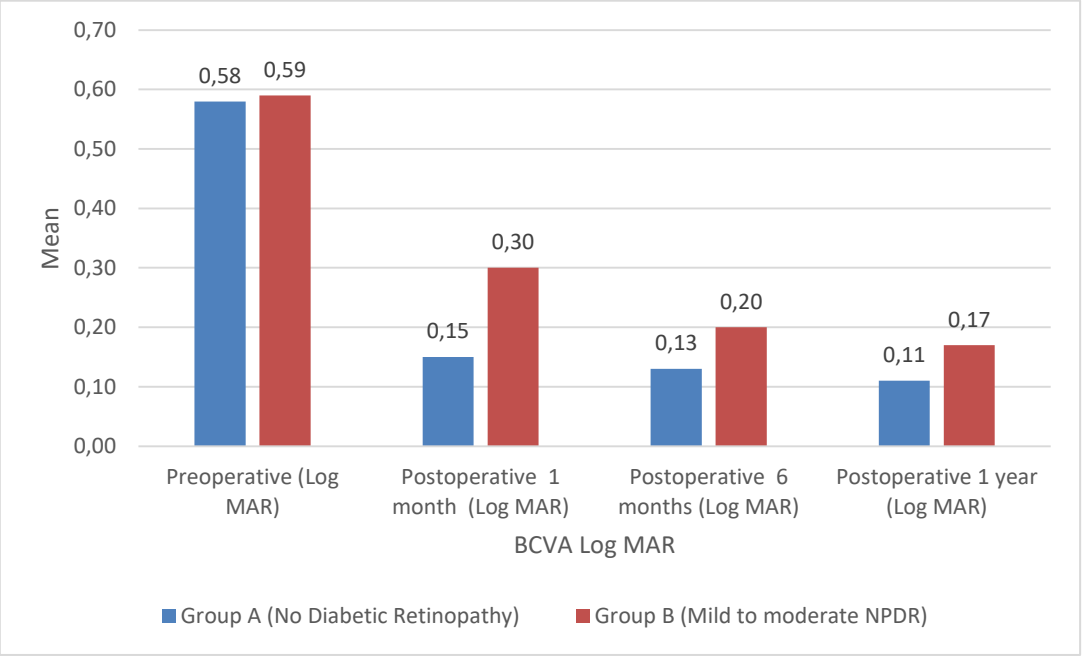
Table 5: Mean BCVA of group A and B preoperatively and postoperatively (1 month, 6 months and 1 year)

Mean BCVA Log MAR	Preoperative (Log MAR)	Postoperative		
		1 month (Log MAR)	6 months (Log MAR)	1 year (Log MAR)
Group A (No Diabetic Retinopathy)	0.58±0.09	0.15±0.22	0.13±0.12	0.11±0.11
Group B (Mild to moderate NPDR)	0.59±0.10	0.30±0.34	0.20±0.20	0.17±0.15
'p' value	0.496^{NS}	0.00^{HS}	0.00^{HS}	0.00^{HS}

NS=Not significant ('p'>0.05); S=Significant (p<0.05); HS= Highly Significant (p<0.001)

Preoperative mean BCVA Log MAR was 0.58±0.09 in group A as compared to 0.59±0.10 in group B There was no significant difference in the preoperative mean BCVA Log MAR between the two groups (p-value=0.496). Mean BCVA Log MAR in group A and group B at 1 month after uncomplicated phacoemulsification was 0.15±0.22 and 0.30±0.34 respectively. There was significant difference in the mean BCVA Log MAR at postoperative 1 month between 2 groups. Mean BCVA Log MAR in group A and group B at 6 months after uncomplicated phacoemulsification was 0.13±0.12 and 0.20±0.20 respectively. There was significant difference in the mean BCVA Log MAR at postoperative 6 months between 2 groups. Mean BCVA Log MAR in group A and group B at 12 months after uncomplicated phacoemulsification was 0.11±0.11 and 0.17±0.15 respectively. There was significant difference between 2 groups at postoperative 1 month, 6 months and 1 year (p-value=0.00), though there was significant increase in BCVA Log MAR at postoperative 1 month,6 months and 1 year in both the groups.

Graph 5: Mean BCVA of group A and B preoperatively and postoperatively (1 month, 6 months and 1 year)



DISCUSSION

In the present study, in group A preoperative mean central macular thickness (CMT) was 229.60±5.16µm and at postoperative 1 month, mean CMT was 259.20±20.57µm. There was significant difference in the preoperative mean CMT and postoperative mean CMT at 1 month (p-value=0.000). Similar to this study, in a study by Haleem A et al[11] significant difference was observed between preoperative (227.93±19.96µm) and postoperative mean CMT (239.98±21.73µm) at 1 month in diabetic patients without DR.

In group A, preoperative mean CMT was 229.60±5.16 µm and at postoperative 6 months, mean CMT was 243.48±11.11 µm. 'p'-value was highly significant (=0.000) in the preoperative mean CMT and postoperative mean CMT at 6 months. In concordance to this study, in a study by Katsimpris JM et al[12], postoperative central foveal thickness (CFT) in diabetics without DR at 6 months was significantly increased compared to preoperative value.

In group A, preoperative mean CMT was 229.60±5.16µm and at postoperative 1 year, mean CMT was 234.03±9.38µm. 'p'-value was highly significant (=0.000) in the preoperative mean CMT and postoperative mean CMT at 1 year. In concordance to this study, in a study by Katsimpris JM et al[12], postoperative central foveal thickness (CFT) in diabetics without DR at 1 year was significantly increased compared to preoperative value.

In the present study, in group B preoperative mean CMT was 232.58±5.06 µm and at postoperative 1 month, mean CMT was 280.03±34.52 µm. There was significant difference in the preoperative mean CMT and postoperative mean CMT at 1 month (p-value=0.000). This is comparable to a study by Liu L et al[13] in which CMT values demonstrated a statistically significant increase after uncomplicated phacoemulsification at 1 month in diabetic patients with NPDR.

In group B, preoperative mean CMT was 232.58±5.06µm and at postoperative 6 months, mean CMT was 254.28±16.46µm. 'p'-value was highly significant (p=0.000) in the preoperative mean CMT and postoperative mean CMT at 6 months. Similarly in a study by Eriksson U et al[14] there was significant increase in mean CMT from preoperatively 216.7

±25.8µm to231.8±36.5µm at postoperative 6 months in diabetic patients with mild to moderate NPDR.

In group B, preoperative mean CMT was 232.58±5.06µm and at postoperative 1 year, mean CMT was 240.21±34.00µm. There was significant ('p'-value=0.027) in the preoperative mean CMT and postoperative mean CMT at 1 year. In concordance to our study, a study by Wang SJ et al[15]observed significant increase in CMT at postoperative 1 year in patients with mild to moderate NPDR.

In this study, in group A, CMT at postoperative 1 month and 6 months was 259.20±20.57µm and 243.48±11.11µm respectively and of group B was 280.03±34.52µm and 254.28±16.46µm respectively. There was significant difference between 2 groups at both postoperative 1 month and 6 months after uncomplicated phacoemulsification. This was comparable to a study done by Liu J et al[16]who observed that CMT values at 1,3 and 6 months are significantly higher in diabetic patients with mild to moderate NPDR after uncomplicated phacoemulsification compared with diabetic patients without DR.

In our study, CMT at postoperative 12 months in group A was 234.03±9.38 µm and in group B was 240.21±34.00 µm. There was no significant difference between 2 groups (p-value>0.05). In contrast to this Wang SJ et al[15] observed that the increased amount of macular thickness was significantly higher in the diabetic group with mild to moderate NPDR than in the non-diabetic group at 1 year.

In group A,11% cases developed macular edema (CMT> 30% of pre-operative value) at postoperative 1 month and they were prescribed topical non-steroidal anti-inflammatory drugs (NSAIDS), out of which 63.6% cases resolved resulting in 4% cases at postoperative 6 months and 81.8% resolved at 1 year resulting in 2% cases in which macular oedema was diminished but not resolved. In group B, 30% cases developed macular edema (CMT> 30% of pre-operative value) at postoperative 1 month and they were prescribed topical non-steroidal anti-inflammatory drugs (NSAIDS), out of which 66.6% cases resolved resulting in 10% cases at postoperative 6 months and 76.6% resolved at 1 year resulting in 7% cases. In concordance to our study, a study by Kwon SI et al[17] peak incidence of macular edema was at 1 month post-surgery and it resolved spontaneously in 68% of patients by 6 months post-surgery and 75% resolved by 1 year. Incidence of macular edema was less than our study as it included severe NPDR and PDR patients with previous laser treatment such as pan retinal photocoagulation or laser treatment for macular edema which have decreased the chances of macular edema.

In our study, mean BCVA Log MAR was 0.15±0.22 in group A as compared to 0.30±0.34 in group B at postoperative 1 month, mean BCVA Log MAR was 0.13±0.12 in group A as compared to 0.20±0.20 in group B at postoperative 6 months, mean BCVA Log MAR was 0.11±0.11 in group A as compared to 0.17±0.15 in group B at postoperative 1 year. 'p'-value was highly significant in the mean BCVA Log MAR at postoperative at 1 month,6 months and 1 year between the two groups. Similarly in a study by Liu L et al[13s], BCVA was observed upto 1year, postoperative mean BCVA Log MAR in diabetic patients without DR was 0.11±0.15 and in diabetic patients with mild to moderate NPDR was 0.15±0.19.

CONCLUSION

The present study concluded that there was significant increase in CMT and BCVA Log MAR at postoperative 1 month, 6 months and 1 year in both groups. At postoperative 1 and 6 months there was significant difference in CMT between both groups whereas there was no significant difference in CMT at 1 year between the 2 groups. There was increased incidence of macular edema at postoperative 1 and 6 months in patients with mild to moderate NPDR. At postoperative 1 month, 6 months and 1 year, there was significant difference in BCVA Log MAR between both groups.

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