

## Macular Changes after Uneventful Phacoemulsification in High Myopic Patients

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### ABSTRACT

**Background:** Pathologic myopia is one of the leading causes of irreversible visual impairment worldwide, particularly in younger individuals.

**Objective:** to evaluate the influence of uneventful phacoemulsification on macular thickness and macular changes in the postoperative period in high myopic patients.

**Patients and Methods:** This is a prospective study which included 30 eyes in patients with high myopia  $\geq -6$  D or with axial length  $\geq 26$  mm underwent cataract surgery. Participants did not have any eye disorders except for myopia and cataract. **Results:** Statistically significant improvement was detected in postoperative best corrected visual acuity (BCVA) and intraocular pressure (IOP). As regard BCVA, preoperative mean was  $0.116 \pm 0.064$  and range was from 0.01 to 0.25 Decimal. 1 week postoperative mean was  $0.495 \pm 0.145$  and range was from 0.32 to 1.00, P-value was  $< 0.01$ . 1-month postoperative mean was  $0.466 \pm 0.16$  and range was from 0.16 to 1.00, P-value was  $< 0.01$ . 3 months postoperative mean was  $0.401 \pm 0.17$  and range was from 0.01 to 0.63, P-value was  $< 0.01$ . As for IOP preoperative mean was  $15.73 \pm 1.14$  mmHg and range was from 13 to 18 mmHg. Postoperative mean was  $14.01 \pm 0.87$  and range was from 12 to 15 mmHg. P-value  $< 0.01$ .

**Conclusions:** There was no statistically significant macular change after phacoemulsification in high myopic patients. There was statistically significant improvement in the BCVA and IOP control.

**Keywords:** Cystoid Macular Edema; Epiretinal Membrane; Macular Hole; Myopia; Optical Coherence Tomography; Schisis; Vitreomacular Traction.

### INTRODUCTION

Myopia is a relatively common ocular disorder, and the prevalence of high myopia in the population was estimated to be approximately 0.5% to 1% <sup>(1)</sup>.

Pathologic myopia is one of the leading causes of irreversible visual impairment worldwide, particularly in younger individuals <sup>(2)</sup>. These morphological changes are probably the underlying cause for the characteristic finding of myopic maculopathy such as staphyloma, fuchs spot, lacquer crack and chorioretinal atrophy <sup>(3)</sup>.

Highly myopic eyes tend to develop cataracts earlier than normal eyes, with higher prevalence of nuclear and posterior subcapsular cataracts <sup>(4)</sup>.

In most cases, phacoemulsification does not change macroscopic fundus appearance of the retina. However, noninvasive imaging techniques such as cross-sectional imaging of the retina with optical coherence tomography (OCT) have shown that macular thickness may increase subclinically after surgery. This subclinical thickening can be detected in many cases of uneventful surgery, with a peak occurring 4–6 weeks after surgery <sup>(5)</sup>.

Spectral-domain OCT (SD-OCT) is exceedingly helpful in diagnosing and differentiating macular pathologies such as epiretinal membranes, full-thickness or lamellar holes, cystoid macular edema (CME), myopic foveoschisis, and dome-shaped macula <sup>(6)</sup>.

Phacoemulsification is associated with an increased rate of posterior vitreous detachment (PVD) in the postoperative period <sup>(7)</sup>.

Posterior vitreous detachment (PVD) progression has been described during phacoemulsification because

of the entrance of liquefied vitreous in the subhyaloid space and subsequent dissection of the remaining adhesions between the posterior vitreous cortex and internal limiting membrane <sup>(8)</sup>.

### AIM OF THE WORK

To evaluate the influence of uneventful phacoemulsification on macular thickness and macular changes in the postoperative period in high myopic patients.

### PATIENTS AND METHODS

This prospective study included a total of 30 eyes of 30 patients with visually significant cataract attending at the outpatient clinic of Al-Azhar University Hospitals.

#### Ethical approval:

Approval of the Ethical Board of Al-Azhar University and a written informed consent from all the subjects were obtained.

This study was conducted between the period from June 2018 to March 2019.

**Inclusion Criteria:** High myopic error  $\geq -6$  diopters or axial length  $\geq 26$  mm, high myopic patients with no clinical fundus changes, patients with senile cataract and refractive lens exchange in high myopic patients with age more than 50 years old.

**Exclusion Criteria:** Patients who refused to participate in the study, media opacity that interfere with preoperative evaluation, congenital or traumatic cataract, macular edema, disease and/or diabetic retinopathy, previous intraocular surgery, topical

glaucoma medications, intraoperative complications (e.g. posterior capsular rupture, bleeding and vitreous loss etc.), History of uveitis, glaucoma and amblyopia and choroidal neovascularization(CNV).

**The included patients were subjected to:**

1. **History taking:** onset, course and duration of diminution of vision, history of ocular trauma, ocular surgery, systemic disorder and drug intake.
2. **General examination:** review for systemic diseases as hypertension, bleeding tendency and renal impairment.
3. **Laboratory investigation:** Basic laboratory investigations including fasting and 2 hours postprandial blood glucose, coagulation profile, liver and kidney function tests, to exclude ineligible cases.
4. **Preoperative ophthalmological examination:** Best corrected visual acuity (BCVA), were evaluated by Landolt C optotype using Snellen’s chart, pupil reaction, refraction using Nidek automated refractometer.
  - Slit lamp examination to assess corneal clarity, depth of anterior chamber, state of pupil dilatation, lens morphology, and any pathological finding.
  - Intraocular pressure (IOP) by Goldman applanation tonometer.
  - Fundus examination: slit lamp biomicroscopy using non-contact Volk 90 Diopter lens.
  - Assessment of ocular motility in all direction of gaze.
  - Examination of ocular adnexa.
5. **Preoperative investigations:**
  - Calculation of the IOL power and axial length by (4 Sight Accutom Ultra-sound, USA) and (Zeiss 500 IOL Master, Germany),
  - Ultra sound to assess the posterior segment especially in posterior staphyloma
  - Optical coherence tomography (OCT) by Topcon 3D 2000 OCT to assess the macula and macular thickness.
6. **Preoperative medication monitoring**
- Topical NSAIDS were given three days before surgery

and topical antibiotics (Moxifloxacin) 1 week before surgery.

- Topical mydriatic (tropicamide 1%) was given one hour before surgery.

**7. Operative details:** Cataract surgery was performed under local anesthesia with sedation or general anesthesia. Anterior limbal scratch incision using keratome (2.4, 2.8, 3 and 3.2 mm), two side ports were made by M VR or Superblade, formation of the anterior chamber by viscoelastic material (sodium hyaluronate 10 mg/ml), anterior continuous circular curvilinear capsulorrhexis was performed under viscoelastic material, hydro-dissection and hydrodelineation, then phacoemulsification of the nucleus, irrigation aspiration, and implantation of intraocular lens in the bag, finally hydration of the wound and the 2 paracentesis ports.

**8. Postoperative follow-up:**

The patients were reviewed at 1<sup>st</sup> day postoperative then at 3 visit (1week, 1 month and 3 months postoperative). 1<sup>st</sup> visit for cornea, wound, AC states IOL position and IOP.

2<sup>nd</sup> visit for BCVA IOL position and IOP.

1 month visit for BCVA, OCT macula, PCO formation and fundus examination.

3 month visit for BCVA, OCT macula, PCO formation and fundus examination.

**9. Statistical analysis**

Recorded data were analyzed using the statistical package for social sciences, version 20.0 (SPSS Inc., Chicago, Illinois, USA). Quantitative data were expressed as mean± standard deviation (SD). Qualitative data were expressed as frequency and percentage.

**The following tests were done:**

- Independent-samples t-test of significance was used when comparing between two means.
- P-value <0.05 was considered significant.

**RESULTS**

As regard the age of studied cases, the mean was 59.8±7.85 and the range was from 42 to 72 years old.

**Table (1):** Age distribution

	Number	Mean	S.D	Minimum	Maximum
Male	16	60.56	8.07	42	72
Female	14	58.93	7.82	47	70
Total	30	59.8	7.86	42	72

As regard the side of operating eye, the results are in table 2.

**Table (2):** Eye distribution

	Number	Percent
Right eye	11	36.7
Left eye	19	63.3
Total	30	100

As regard the axial length of studied cases, the mean was 26.9±141 and it ranged from 25 to 30.52 mm.

As regard the refraction of studied cases the difference was statistically significant between pre- and postoperative values (Table 3).

**Table (3):** Refraction of studied cases preoperative and postoperative

	Mean	S.D	Minimum	Maximum	t-test	P-value
Preoperative	9.96	3.68	6.25	20	10.98	<0.01
Postoperative	- 0.12	1.82	-5	3		

\*Significant at P-value < 0.05.

As regard the cases of IOL power miscalculation data are shown in table 4.

**Table (4):** IOL power miscalculation

	Number	Percent %
myopic shift	3	10
Hyperopic shift	1	3.33
IOL power miscalculation	4	13.33

As regard the IOP of studied cases the difference was statistically significant between pre- and postoperative values (Table 5).

**Table (5):** Intraocular pressure of studied cases pre and postoperative.

	Mean	S.D	Minimum	Maximum	t-test	P-value
Preoperative	15.73	14	13	18	5.77	<0.01
Postoperative	14.01	87	12	15		

\*Significant at P-value < 0.05.

As regard the type of lens cataract of studied cases, data are shown in table 6.

**Table (6):** Types of lens cataract of studied cases.

	Number	Percent %
RLE	5	16.7
Immature cortical cataract	3	10
PSC	5	16.7
Nuclear cataract grade I	6	20
Nuclear cataract grade II	11	36.77
Total	30	100

\*RLE = Refractive lens exchange \*\* PSC = Posterior sub-capsular

As regard the CMT of studied cases, the difference was not statistically significant among pre- and postoperative values (Table 7).

**Table (7):** Central macular thickness (CMT) preoperative and postoperative

	Mean	S.D	Minimum	Maximum	t-test	P-value
Preoperative	222.67	50.83	103	300	1.0	0.326
Postoperative at 1 month	229.57	67.48	103	471		
Postoperative at 3 month	221.17	3.37	Zero	300	0.399	0.693

\*Significant at P-value < 0.05.

As regard BCVA of studied cases, the difference was statistically significant among pre- and postoperative values (Table 8).

**Table (8):** Best corrected visual acuity (BCVA) preoperative and postoperative

	Mean	S.D	Minimum	Maximum	t-test	P-value
Preoperative	0.116	064	0.01	0.25	16.08	<0.01
Postoperative at 1 week	0.495	145	0.32	1.00		
Postoperative at 1 month	0.466	16	0.25	1.00	13.72	<0.01
Postoperative at 3 month	0.401	17	0.01	0.63	10.47	<0.01

\*Significant at P-value < 0.05.

As regard postoperative PCO of studied cases, the results are shown in table 9.

**Table (9):** Posterior capsular opacity (PCO)

		Number	Percent %
PCO after 1 month	Yes	2	6.7
	NO	28	93.3
PCO after 3 months	Yes	4	13.3
	NO	26	86.7
Total	Yes	6	20
	No	24	80

As regard postoperative fundus examination at 1 and 3 months of studied cases, the results are shown in table 10.

**Table (10):** Postoperative fundus examination

	Number	Percent %
NAD	27	90
Macular edema	2	6.7
RD	1	3.3
Total	30	100

\*NAD= No abnormality detected      \*\*RD= Retinal detachment

As regard PVD of studied cases, the results are shown in table 11.

**Table (11):** Postoperative posterior vitreous detachment (PVD)

		Number	Percent %
PVD	Yes	4	13.3
	NO	26	86.7
	Total	30	100

## DISCUSSION

Myopia is highly prevalent in the general population, affecting approximately 25%. It affects a larger proportion of Asians and a smaller proportion of African Americans. High myopia affects about 2% of the population. High myopia refers to a spherical equivalent of -6.0 D or less or an axial length of 26.5 mm or more (9).

Cataract surgery has evolved over past several decades from large incision intracapsular cataract extraction (ICCE) to phacoemulsification. Despite surgical improvement, CME continues to be a cause of postoperative visual disturbance (10).

Phacoemulsification even when uncomplicated may have an impact on healthy retina; this could be attributed to factors such as the intraoperative photo

stress due to the microscope light or the intraoperative changes of IOP due to surge; and the damage of BRB. These impacts may be expressed as a temporary thickening of retina, without causing any permanent retinal damage or affecting visual acuity (11).

OCT is a noncontact technique that allows frequent measurement of the retinal thickness and is well tolerated by patients. It has a high degree of reproducibility and repeatability and can be demonstrate cystic changes. In the contrary to fundus fluorescein angiography (FFA), it quantifies retinal thickness in the patients with cystoid macular oedema (CMO) (12).

In this study all patients underwent uneventful phacoemulsification with posterior chamber IOL implantation.

**Ashraf et al.** <sup>(13)</sup> published the following results during follow up of 34 consecutive patients who underwent a phaco surgery in high myopic eyes performed by the same surgeon and were prospectively evaluated for a minimum period of 6 months. They were 20 women and 14 men aged 45-84 years. All the 34 eyes underwent the baseline and 2-month evaluations, but only 18 eyes underwent the final examination at 6 months. The causes of loss to follow up were as follows: one patient died; one patient became bedridden due to hip fracture; and the remaining patients either did not respond to follow up phone calls or did not consent for further evaluation.

**As regard CMT**, three eyes out of 34 eyes (8.8%) developed CME at 2 months, and one eye out of 18 (5.6%) developed new CME at 6 months. **As regard PVD**, preoperative incidence was about 9 (36%) eyes, which was not changed at the end of 2 and 6 months.

Our results showed 2 eyes, out of 30 eyes (6.7%), developed CME; one at the end of first month and the other at the end of third month. Preoperative PVD incidence was 26 eyes from 30 eyes (86.7%), and postoperative PVD incidence was 4 eyes (13.3%). 1 eye (3.3%) had retinal detachment

**Mirshahi et al.** <sup>(14)</sup> published the following results during follow up of 188 consecutive patients, (131 women and 57 men) who underwent a cataract extraction in high myopic eyes and were prospectively evaluated for a minimum period of 1 year duration with a mean age of 77.2 years. Preoperatively, 130 eyes (69.1%) had PVD and 58 eyes (30.9%) had no PVD. Postoperatively, 12 eyes (20.7%) developed PVD at 1 week, 18 eyes (31%) at 1 month, and 4 eyes (6.9%) at 1 year. The vitreous body remained attached to the retina in 24 eyes (41.4%) 1 year after surgery.

**Cetinkaya et al.** <sup>(15)</sup> published the following results during follow up of 43 eyes of 28 consecutive patients (12 males, 16 females) with cataract and high myopia who had undergone phacoemulsification and intraocular lens (IOL) implantation. The mean standard deviation of the age of the patients was 59.20 (39-77) years.

**As regard type of cataract**, twenty-five eyes (58.2%) had nuclear cataracts, 9 eyes (20.9%) had cortical cataracts, and 9 eyes (20.9%) had posterior subcapsular cataracts. The frequency of nuclear cataracts was significantly higher than that of other cataract types ( $P=0.003$ ).

**As regard refraction**, preoperative refraction mean  $\pm$  standard deviation was  $[-16.48 \pm 5.23]$  and range was from (-8.00 to -25.00) D and the mean postoperative refraction was  $[-1.46 \pm 0.93]$  (0.00 to -3.00) D;  $P<0.01$ ].

**As regard vision**, preoperative BCVA mean was 0.125 (0.50 to 0.05) and the postoperative refraction was 0.50 (1.00 to 0.25) Decimal.

Our study showed that 17 eyes had nuclear cataracts (56.77%), 5 eyes had PSC (16.7%), 5 eyes had

RLE (16.7%) and 3 eyes had immature cortical cataract (10%). According to refraction, preoperative refraction mean was  $(-9.96 \pm 3.68)$  and it ranged from (-6.25 to -20) D and the postoperative refraction mean was  $(-0.12 \pm 1.82)$  and it ranged from (-5 to +3) D;  $P<0.01$ . Also this study showed 4 eyes (13.33%) with IOL miscalculation, 3 eyes with myopic shift more than -3D and 1 eye with hyperopic shift more than 3D. According to visual acuity, preoperative BCVA mean was  $(0.116 \pm 0.064)$ . Postoperative BCVA was statistically significantly improved, at the first week the mean was  $(0.495 \pm 0.145)$ , at the first month was  $(0.466 \pm 0.16)$  and the range was from (0.25 to 1.00), at the end of third month the mean was  $(0.401 \pm 0.17)$  and it ranged (0.01 to 0.63) Decimal.

**Zuberbuhler et al.** <sup>(16)</sup> found that during follow up of one hundred seventy-seven eyes (124 patients) with cataract and high myopia who had undergone phacoemulsification and intraocular lens (IOL) implantation; posterior capsular opacity (PCO) was demonstrated to be 31.6% within 3 month postoperatively.

Our study showed 6 eyes (20%) out of 30 eye with postoperative PCO, 2 eyes (6.7%) at the end of first month and 4 eyes (13.3%) at the third month.

## CONCLUSION

- There was no statistically significant macular change after phacoemulsification in high myopic patients.
- We found that there was significant improvement in the BCVA and IOP control. This improvement is statistically significant.
- Frequent follow up of patients is important to detect the complications.

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