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To Assess the Changes of Macular Thickness Pre and Post Phacoemulsification on Optical Coherence Tomography

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ABSTRACT
In retinal nerve fiber layer analysis, RNFL thickness measurement is graphed in a TSNIT orientation and compared to age matched normative data. Decreased RNFL thickness represents glaucoma. To assess the macular thickness before and after phacoemulsification cataract surgery. To assess the effect of media opacity like cataract on OCT measurements. A hospital based Prospective, Single Centre study was carried out Patients attending the Ophthalmology OPD who gave a written informed consent to be a part of this study at tertiary care Centre. The study was conducted from August 2022-2023. The mean age at presentation was 59.50 ±7.81 years. 89 (44.5%) are females and 111(55.5%) are male. 14 (7%) were having cortical cataract, 47 (23.5%) nuclear cataract only, 23 (11.5%) had posterior sub capsular cataract only and 116 (58%) of the eyes had both nuclear and posterior sub capsular cataract together. Mean central macular thickness increased from 234.71±16.35µm to 238.79±15.70µm. The presence of lenticular opacity significantly affects macular thickness using Cirrus OCT. Macular thickness can be expected after cataract surgery and we recommend obtaining fresh OCT images after cataract surgery.

INTRODUCTION

Optical coherence tomography (OCT) is an imaging technology that employs low-coherence interferometry to obtain cross sectional images of the ocular tissues, both anterior segment and posterior segment. Posterior segment OCT uses light of 830nm to obtain images of the posterior segment structures, such as optic nerve head (ONH), retinal nerve fiber layer and macula. OCT has evolved through different modifications from OCT to fourier domain/spectral domain OCT. The newer method of spectral domain (SD) OCT has higher speed and resolution than its predecessor, Stratus OCT. Spectral-domain OCT also captures three-dimensional images of optic disk and surrounding tissue components. Axial resolution of spectral-domain (SD) OCT is twice higher (5-7 microns) than stratus OCT (approximately 10 microns). In 2006, Heidelberg engineering introduced spectralis-the first imaging platform that combined SD-OCT with scanning laser ophthalmoscope. Three of the commonly used SD-OCT devices are the Spectralis (Heidelberg Engineering, Dossenheim, Germany), the Cirrus (Carl Zeiss Meditec, Dublin, CA) and the RTVue (Optovue Inc, Fremont, CA). The analysis of retinal nerve fibre layer thickness (RNFL) with OCT has been a reliable in discriminating normal from glaucomatous eyes. RNFL thickness is measured on a cross-sectional retinal image sampled along a 3.4-mm diameter circle centered on the optic nerve head (ONH).

Optical coherence tomography (OCT) was used in many previous studies and have reported that the retinal nerve fibre thickness measurements can be increased after uncomplicated cataract surgery because the lens opacity of cataract may affect the retinal nerve fibre thickness measurements. These studies found that the increase in retinal nerve fibre layer thickness measurement after phaco surgery is because of improvement in transmittance and reflectivity of the RNFL boundary after removal of opacified lens, rather than actual RNFL thickening after cataract surgery[1]. Literature suggests that ocular surgery, whether that of the anterior segment or of the posterior segment, does affect the retinal nerve fiber layer thickness. In present study Optical coherence tomography (OCT)is used to analyse the thickness macula before and after phacoemulsification surgery and lens opacities classification system III (LOCS III) is used to grade the cataract. In this study we aim to assess the effect of ocular media opacity secondary to cataract on macular thickness determined by OCT pre-operatively and post-operatively in patients attending the Ophthalmology OPD undergoing phacoemulsification cataract surge.

Materials and Methods

A hospital based Prospective, Single Centre study was carried out Patients attending the Ophthalmology OPD who gave a written informed consent to be a part of this study at tertiary care Centre. The study was conducted from August 2022-2023.

Sample Size: 200 eyes.

Inclusion Criteria:

- Suitable lens opacities (cataract) not interfering with OCT examination.
- Patients giving consent for the study.

Exclusion Criteria:

- Patients with retinal diseases like macular degeneration, macular hole, vascular diseases, epiretinal membranes.
- Ocular diseases like uveitis, previous history of intraocular surgery and laser treatment.
- Patients who had systemic diseases like diabetes that could affect the eye.
- History of ocular injury / blunt trauma
- Corneal pathologies like dystrophies, degeneration, ectasia (irregular surface)
- Patients who were on topical or systemic steroid or diuretics that may affect retinal thickness
- Patients with dense cataract interfering with OCT analysis
- Those who do not sign the consent
- Non cooperative patient

Tools:

- **Cataract Grading:** LOCS III standard images in a 8.5-inch x 11-inch color transparency. Slit lamp image of every eye is compared with 6 standard color photographic transparencies on a scale of 0-6 of LOCS III which is in the top most row of colour transparency.

- **Sd-Oct:** CIRRUS HD-OCT machine (fig 24)was used for measurements. These recordings were taken by an experienced examiner. RNFL thickness measurements were obtained by OCT machine using the Optic Disc 200x200 protocol. Macular analysis done by OCT machine using macular thickness map protocol (Macular cube 512x128). The macular thickness at the fovea is noted for the study before and after phacoemulsification surgery. Signal strength noted on every scan.

- **Phacoemulsification Machine:** Alcon Constellation phacoemulsification machine was used for cataract surgery of all patients included in the study.

- After obtaining their informed written consent, detailed history and examination (general, local) will be done by the investigator herself.
- A complete ophthalmologic examination included best-corrected visual acuity by Snellen's visual acuity chart. The anterior segment of each eye examined by slit-lamp for corneal opacities or abnormalities, depth of anterior chamber, uveitis, and lens position.
- Cataract grading done using LOCS III system.
- The Fundus examination was done by indirect ophthalmoscope and 90D lens for examination of the macula, optic disc, retinal vessels, retinal background and retinal nerve fiber.
- After assessing patients for inclusion and exclusion criteria, they are posted for phacoemulsification cataract surgery.
- Signal strength of all scans noted on all visits.
- Peripapillary macular thickness measured using optical coherence tomography (OCT) 1 day before and 1 week after surgery. The average of these scans was used for the analysis.

Statistical Analysis: The clinical data collected was entered in MS Office Excel and analysed using Statistical package software [SPSS 20.0]. Data is presented in the form of tables, figures, graphs, wherever necessary. Descriptive statistics were calculated in the form of: Mean and Standard deviation (±SD), Median and Inter-Quartile Range (IQR) for quantitative data. Frequency and Distribution for qualitative data, wherever necessary. Pearson Chi-square test of significance was used to find the association between the categorical variables where-ever applicable. P-value <0.05 is considered as statistically significant.

RESULTS AND DISCUSSIONS

The study consisted of 200 cases out of which 15.5% were between age group of 45-50, 20.0% were between the age group of 51-55, 19.5% between the age group of 55-65, 17.0% were between 66-70 and 7.5% were between the age group of 71-75 and 1% were >75 years of age. The mean age at presentation was 59.50 ±7.81 years. The study consisted of 200 cases out of which 89 (44.5%) are females and 111(55.5%) are male.

Among 89 females maximum distribution was in 51-55 age groups and among 111 males it was found in 61-65 years of age

Impression: This table shows that 200 eyes included in the study 14 (7%) were having cortical cataract, 47 (23.5%) had nuclear cataract only, 23 (11.5%) had posterior sub capsular cataract only and 116 (58%) of the eyes had both nuclear and posterior sub capsular cataract together. Majority of the patients had nuclear with capsular cataract during presentation.

This table shows the analysis of 200 eyes for signal strength, Mean central macular thickness is 234.71±16.35µm.

The statistical analysis of central macular thickness pre and post operatively. In this study P-value is more than 0.05, hence this proves that there is a no statistically significant association between Pre and Post-op central macular thickness. Therefore the increase in central macular thickness post operatively is statistically significant.

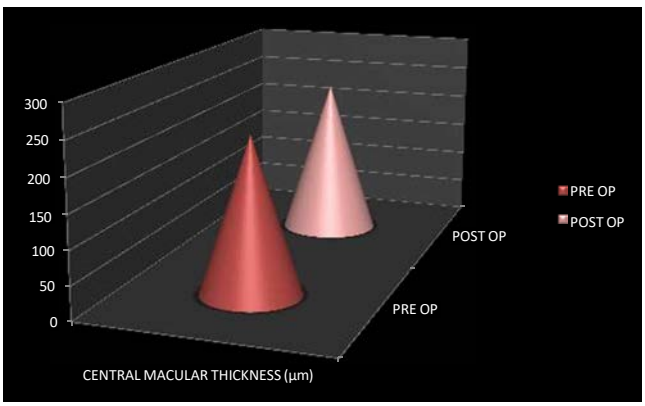
This was a Prospective, Observation, Single Centre study on 200 eyes with cataract presenting attending the Ophthalmology OPD, Bharatratna Dr. Babasaheb Ambedkar Memorial Hospital, tertiary care centre, Byculla, .

A total of 200 eyes with cataract were recruited. All the patients were subjected to macular OCT analysis pre operatively and after undergoing phacoemulsification. The pre-operative and post-operative readings were compared and analyzed statistically.

In the present study mean age was 59.50 ±7.81 years and the range was 45-77 years which is similar to following studies. Shahid M[3]. who reported the mean age of the patients at 60.3±7.9 years.

In the present study 55.5% were males while 44.5% female it was found almost an equal number of affected male and female with a ratio of 1:1.2. Shahid [4]. study had equal male to female ratio.

Of the 200 eyes included in the present study 14 (7%) were having cortical cataract only, 47 (23.5%) had nuclear cataract only, 23 (11.5%) had posterior sub capsular cataract only and 116 (58%) of the eyes had



Graph. 1: Preoperative and post operative macular thickness

Table 1: Gender distribution

Sex	Frequency	Percent
Female	89	44.5
Male	111	55.5
Total	200	100.0

Table 2: Distribution based on type of cataract

Type of cataract	Frequency	Percent
Cortical Cataract	14	7.0
Nuclear + PSC	116	58.0
Nuclear cataract	47	23.5
Posterior Sub-capsular Cataract	23	11.5
Total	200	100.0

Table 3: Pre operative parameters analysis

	Age	Pre-op central macular thickness(µm)
Mean		
Std.	59.49	234.71
Deviation	7.818	16.35
Minimum	46	201
Maximum	77	273

Table 4: Post operative parameters analysis

	post-op central macular Thickness(µm)
Mean	238.79
Std.	
Deviation	15.703
Minimum	201
Maximum	276

Table 5: Pre and post-op macular thickness

Paired Samples	Mean	N	Std. Deviation	Std. Error Mean
Statistics (paired t-test)				
Pre-op central macular thickness(µm)	234.71	200	16.350	1.156
Post-op central Macular thickness (µm)	238.79	200	15.703	1.110

both nuclear and posterior sub capsular cataract together. Majority of the patients had nuclear with capsular cataract during presentation. But van Velthoven[3]. nuclear (n= 12), cortical (n= 10) and posterior (n= 7) cataract studied 29 patients of which nuclear cataract was a majority. Of 200 eyes analysed in present study Mean central macular thickness is 234.71±16.35µm pre operatively increasing to 238.79±15.70µm post cataract surgery. Our study results corroborated with several other studies as follows: Kazim NA[1] reported the mean foveal thickness was 180.5 µm ± 26.3 µm prior to cataract surgery and 196.7 µm ± 30.9 µm following cataract surgery (P< 0.0001).

Gharbiya[4] documented Retinal thickness of the central fovea of the operated eyes began to significantly increase from the first month after surgery. Macular thickness increased from 225.6±21.6 µm to 229.6±20.2 µm post-operative week[1]. Abdo[5] showed in their study that the Pre-operative Central Macular Thickness of 229.9±35.02 µm increased to 257.8±25.15 µm 1w post-operative. Pardianto G[6] showed that there were statistically significant differences in macular thickness between preoperative and postoperative 214.07±59.95 µm to 236.67±63.67 µm respectively on spectral domain optical coherence tomography examinations

CONCLUSION

A Prospective, Single Centre study was done to study the effect of media opacity like cataract on the OCT parameters i.e. central macular thickness in glaucoma and non-glaucoma patients. Patients were examined and underwent phacoemulsification cataract surgery. We found all the subtypes of cataract (cortical, nuclear, posterior sub capsular and mixed type) to significantly affect macular thickness in both non glaucoma patients and glaucoma patients. In conclusion, our data suggest that the presence of lenticular opacity significantly affects macular thickness using Cirrus OCT In clinical practice, macular thickness can be expected to change after cataract surgery and we recommend obtaining fresh OCT images after cataract surgery.

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