

Study of change in macular thickness pre and post small incision cataract surgery and its correlation with Best corrected visual acuity.

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Abstract:

INTRODUCTION: The aim of our study is to analyze the change in macular thickness in all its 9 quadrants pre- and post-small incision cataract surgery and to correlate with best corrected visual acuity.

METHODS: Macular thickness of patients who underwent uncomplicated small incision cataract surgery were recorded pre-operatively and on post-operative day 1, 1-week, 1 month and 3 months using NIDEK RS 3000 OCT Scan. And the BCVA was recorded at the end of 4 weeks and 3 months and macular thickness was correlated with BCVA.

RESULT: There was significant increase in macular thickness found in all the 9 quadrants ($p < 0.0001$) at post-operative day 1, 1-week, 1 month and return to baseline value at 3 months. There was significant improvement in best corrected visual acuity from preoperative to post-operative 1 month ($p < 0.0001$).

CONCLUSION: Thus, it was concluded that there was significant increase in macular thickness with its peak at 1 month followed by return to baseline value at 3 months. No correlation was found between bcva and macular thickness changes.

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I. Introduction:

Cataract remains one of the leading causes of blindness in the world and cataract surgery is one of the most frequently performed surgical procedures. The most recent estimates from WHO reveal that 47.8% of global blindness is due to cataract and in South Asia region which includes India, 51% of blindness is due to cataract⁽¹⁾. In India, an estimated 20 lakhs new cases of cataract are being added to the burden every year.⁽²⁾

Cataract surgical rate (CSR) is a quantifiable measure of the delivery of cataract services in a country⁽¹⁾⁽³⁾. There has been a substantial increase in CSR in India that is around 3000 / million population. Most of the bigger states in the country have already achieved a CSR of > 4000 per million population.⁽⁴⁾ Global current CSR is around 4000 million population.

Cystoid macular edema (CME) is the most common cause of visual impairment related to the postoperative period of uncomplicated cataract surgery. It occurs between the fourth and tenth postoperative week with the presenting symptoms of slow onset diminution of vision, metamorphia, photophobia, reduced contrast sensitivity, central scotoma or some combination.⁽⁵⁾⁽⁶⁾ CME presents in two forms: one is a subclinical type in which macular thickness is observed on optical coherence tomography and there is no reduction of visual acuity whereas the other type is associated with the reduction of visual acuity.

The exact pathomechanism of CME is not known. The role of surgical trauma with release of prostaglandins and blood retinal barriers is suspected to be the cause. Mechanical traction on perifoveal retinal capillaries during phacoemulsification may contribute to CME.⁽⁷⁾ Inflammatory mediators when diffused to the vitreous and retina cause vasodilatation and disruption of the blood-retinal barrier and the fluid accumulation in the retina can develop CME⁽⁸⁾. The incidence of CME with clinically significant vision loss after phacoemulsification surgery is only 0.2%–1.4%⁽⁹⁾⁽¹⁰⁾. But the frequency of CME depends on the diagnostic method used for evaluation. With the use of more sensitive instruments like OCT; the estimated rate is 4%–40%. In majority of cases CME regresses spontaneously after 3–12 months and only 1% of patients experience the loss of visual acuity.⁽¹¹⁾

II. Methodology:

All patients coming to NIMS OPHTHALMOLOGY DEPARTMENT with cataract and willing for small incision cataract surgery underwent detailed history and examination. Preoperatively best corrected visual acuity (BCVA) slit lamp examination, IOP measurement and dilated fundus examination by indirect ophthalmoscopy to rule out any pre-existing retinal pathologies. Inclusion and exclusion criteria were applied and those who fulfilled the criteria were enrolled in the study and were planned for small incision cataract surgery under a single surgeon. Macular thickness was measured preoperatively by OCT (NIDEK RS -3000) using macular radial map. Small incision cataract surgery was performed on the enrolled patients. Patients who underwent uncomplicated small incision cataract surgery were examined further. Macular thickness of 120 patients who underwent uncomplicated small incision cataract surgery were recorded on post-operative day 1, 1-week, 1 month and 3 months using RS 3000 OCT Scan. And BCVA were recorded at the end of 4 weeks and 3 months and further macular thickness was correlated with BCVA.

Inclusion Criteria:

1. All patients of either sex who underwent Small incision cataract surgery.
2. Age 40 years and above.
3. Had given voluntary written informed consent for the study.

Exclusion Criteria:

1. Patient's with history of Uveitis, ARMD (Age Related Macular Degeneration), glaucoma, h/o retinal detachment or any other retinal pathology.
2. Patient's with systemic disease like Hypertension or Diabetes or cardiac or blood disorders.
3. Media Opacities (corneal opacities and vitreous opacities)
4. Patient's with mature or hypermature cataract, traumatic cataract and complicated cataract.
5. Patients who will not be able to sit for OCT examination i.e with any bony deformities.
6. Uncooperative and unreliable patient.

After pre-operative assessment and application of inclusion and exclusion criteria patients were selected for small incision cataract surgery.

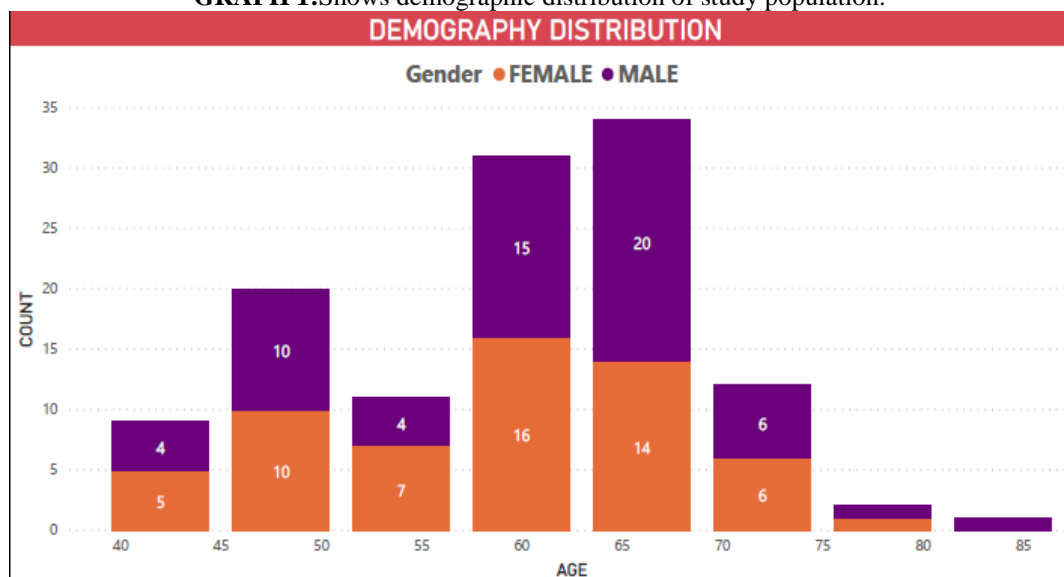
III. Result and Observations:

1. Age/Sex Distribution:

Table 1. shows the demographic data distribution of 120 patients included in this study. The mean age of patients included in the study was 61.50 ± 9.089 .

Age Group	Number of Patients
40-55	37
56-70	62
71-85	20

GRAPH 1: Shows demographic distribution of study population.



2.Pre-Operative and Post-Operative BCVA: BCVA was recorded by Snellen's chart and was converted into decimal.

Table 2 shows statistically significant improvement in visual acuity from preoperative value ($p < 0.0001$). There was further improvement in some of the cases at 3 months ($P > 0.05$).

BCVA	MEAN±STANDARD DEVIATION(in decimal)	P-VALUE
PRE-OPERATIVE:	0.15±0.11	
BCVA POST-OP 1 MONTH	0.89±0.15	P<0.0001
BCVA POST -OPERATIVE 3 MONTHS	0.95±0.085	P>0.05

GRAPH 2: shows significant increase in best corrected visual acuity from pre-operative to post-operative 1 month ($p < 0.0001$) and slight increase in 3 months in some cases.

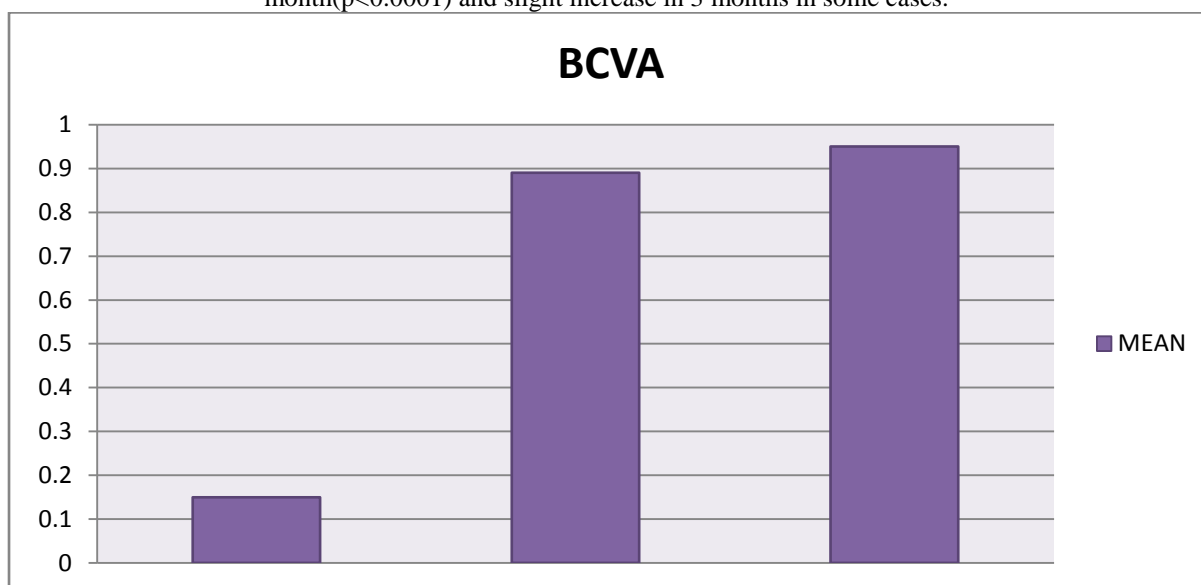


Table 3:

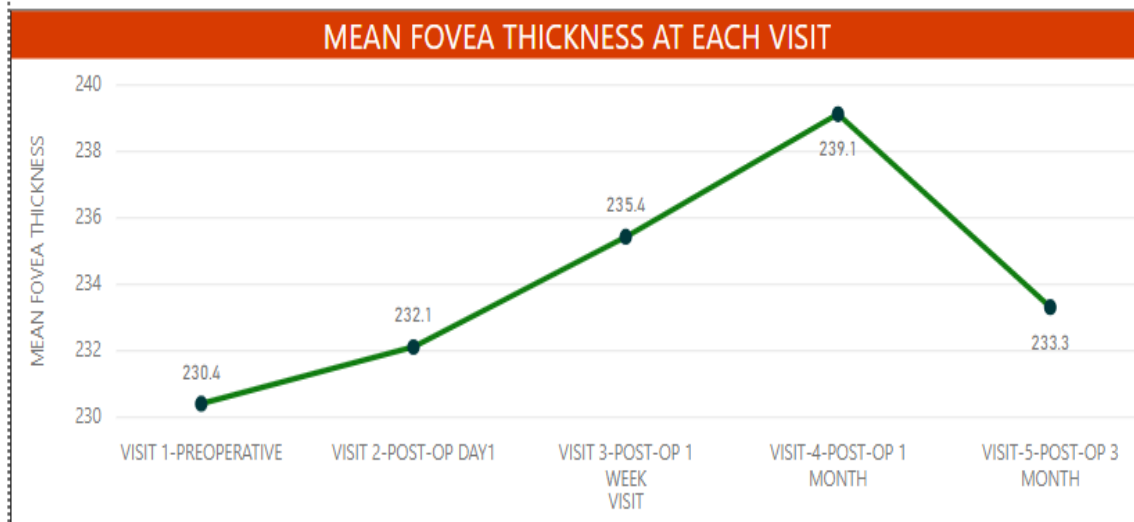
Pre-operative macular thickness was recorded by RS-3000 SD-OCT macular map for all the 9 quadrants pre-operatively. Pre-operative values were kept as baseline values for this study.

MACULAR AREA	MEAN THICKNESS ± STD DEVIATION(PRE-OP)	POST OP DAY 1	POST -OP WEEK 1	POST OP 1 MONTH	POST -OP 3 MONTH
FOVEA	230.49±14.42	232.11±14.51	235.43±14.87	239.1±14.86	233.31±15.97
SUPERIOR INNER	291.25±12.50	293.18±12.16	295.65±12.61	296.77±12.80	293.64±12.12
NASAL INNER	296.41±12.50	298.54±12.27	301.25±12.37	302.32±12.50	298.4±11.72
INFERIOR INNER	291±11.83	293.31±11.55	295.30±11.68	296.48±11.81	293.04±11.04
TEMPORAL INNER	287.66±11.89	289.32±11.61	291.25±11.94	291.92±11.97	288.78±12.04
SUPERIOR OUTER	254.95±9.65	256.27±9.22	258.92±10.04	259.98±9.90	256.64±9.95
NASAL OUTER	277.68±13.31	278.86±14.21	280.69±14.64	282.79±13.87	278.48±14.18
INFERIOR OUTER	245.90±10.98	247.6±11.73	250.05±12.44	251.30±12.52	247.24±11.24
TEMPORAL OUTER	237.74±9.90	238.71±10.24	240.40±10.52	241.19±11.02	239.05±12.55

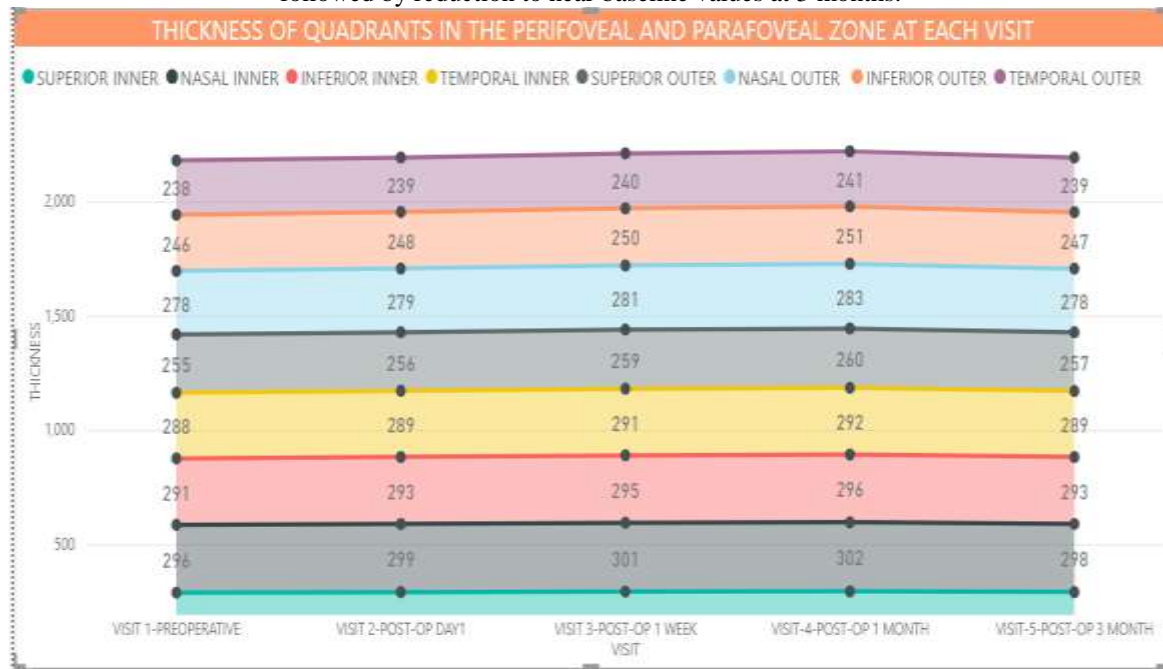
Shows significant increase in macular thickness in all the 9 quadrants ($p < 0.0001$) from the macular thickness at all post op visits.

Graph 3:

Shows increase in mean foveal thickness with its peak at 1 month followed by reduction to near baseline value in 3 months.



Graph 4 :Shows an increase in macular thickness in perifoveal and parafoveal areas with its peak at 1 month followed by reduction to near baseline values at 3 months.



IV. Discussion:

The study by **Anu F et al**⁽¹²⁾ was an observational prospective investigation of 99 patients who underwent cataract surgery (SICS). In our study of 120 patients the mean age of the patients involved was 61.50 ± 9.089 . Similar to Anu F study majority(40%) of our study population was within the age group of 60-70 yrs. The average BCVA of the operated eyes was significantly improved with respect to that of the fellow eyes at all time slots after 3 weeks of surgery. Similarly, in our study there was significant increase in best corrected visual acuity from pre-operative to post –operative 1 month value followed by non-significant increase at 3 months.

In our study there was significant increase in the macular thickness in all quadrants from pre-operative value to post-operative day 1. P value was significant in all quadrants indicating a significant increase in macular thickness post cataract surgery at day 1. Results similar to our study were found by **Biro et al**⁽¹³⁾ that is significant change in the macular thickness on post-operative days 1 in the 3.0 mm and 6.0 mm sectors either calculated alone or when averaged together with the foveal value. Majority of the studies have shown a

significant increase in postoperative day 1 including studies by **S Ramakrishnan et al**⁽¹⁴⁾ and **Vimal J Vyas et al**⁽¹⁵⁾.

Contrary to our finding **M.Garbhiya et al**⁽¹⁶⁾ found a significant decrease in macular thickness on day 1 post-operatively in all the subfields which was said to be related to the effect of lens opacification on the preoperative OCT measurements or due to an apparent thinning of the retina, when the lens is replaced by an IOL as cataract surgery causes light scattering effect and could lead to artifacts in OCT measurements.

On post-operative day 7 there was further significant increase observed in all the macular subfields in our study. Results similar to our study has been found by namely **S Ramakrishnan et al**⁽¹⁴⁾. In study by **Anu F et al**⁽¹²⁾ on contrary significant increase was found in temporal inner and nasal outer in the post-operative week 1.

In our study the peak rise in macular thickness was observed at 1 month followed by a declining trend to near baseline value at 3 months. Similar to our study **Biro et al**⁽¹³⁾ observed a peak increase in 1 month followed by declining trend at 3 months. In a recent study by **O.P.Akarsu et al**⁽¹⁷⁾ similar results were found that is peak macular thickness at 1 month followed by declining trends to baseline values at 3 and 6 months post-operatively.

Majority of the studies have showed peak increase in macular thickness at 1 month including **M Garbhiya et al**⁽¹⁶⁾ but contrary to our study they showed an increasing trend uptill 6 months postoperatively.

There was significant improvement in the post-operative BCVA from pre-operative value. Thus, indicating no correlation between increase in macular thickness (subclinical levels) and BCVA.

There was not more than 10 percent increase in macular thickness in any of the patients in our study and there was no patient of clinically significant macular edema found in this study. Similar to our study **S Ramakrishnan et al**⁽¹⁴⁾, **O.P.Akarsu et al**⁽¹⁷⁾ found increase in macular thickness with no significant CME in uncomplicated cases. In the study by **Garbhiya et al**⁽¹⁶⁾ only two clinically significant CMO cases. Thus, it was concluded that macular thickness recorded after uneventful cataract surgery although statistically significant were at subclinical levels.

V. Limitations:

- The relatively short post-operative duration over which patients came for review. An important reason for this was that in the absence of notable complications patients felt it was not necessary to present for review. As the clinical cystoids macular edema takes 4-12 weeks to develop the follow up period can be longer, and the results may have been different.
- Another limitation was the surgical time was not taken into account which could increase the inflammation and lead to increase in macular thickness.
- Very advanced cataract (nuclear sclerosis grade 4 and 5, mature cataract and hyper mature cataract) was not included in the study because of the limitation of OCT to measure macular thickness in very dense cataracts.

VI. Conclusion:

The best corrected visual acuity significantly increases from pre-operative value (into post-operative value. Visual acuity of all the patients was >6/12 thus showing good postoperative results. There was significant increase in macular thickness in all quadrants in all post-operative visits with its peak at month and decrease to near normal values in 3 months. There was no correlation found between change in macular thickness and BCVA at subclinical level. CT showed macular edema without altering the architecture of the macula (subclinical macular oedema). None of the patients in our study developed clinically significant macular oedema.

Bibliography:

- [1]. Yilmaz T, Cordero-Coma M, Gallagher MJ. Ketorolac therapy for the prevention of acute pseudophakic cystoid macular edema: A systematic review. *Eye*. 2012.
- [2]. Murthy GVS, Gupta SK, Bachani D, Jose R, John N. Current estimates of blindness in India. *British Journal of Ophthalmology*. 2005.
- [3]. Bowling B. *Kanski's Clinical Ophthalmology: A Systematic Approach*. Eighth Edition. Cornea. 2016.
- [4]. Yonekawa Y, Kim IK. Pseudophakic cystoid macular edema. *Current Opinion in Ophthalmology*. 2012.
- [5]. Sheppard JD. Topical bromfenac for prevention and treatment of cystoid macular edema following cataract surgery: A review. *Clinical Ophthalmology*. 2016.
- [6]. Yüksel B, Kartı Ö, Kusbeci T. Topical nepafenac for prevention of post-cataract surgery macular edema in diabetic patients: Patient selection and perspectives. *Clinical Ophthalmology*. 2017.
- [7]. Bélaïr ML, Kim SJ, Thorne JE, Dunn JP, Kedhar SR, Brown DM, et al. Incidence of Cystoid Macular Edema after Cataract Surgery in Patients with and without Uveitis Using Optical Coherence Tomography. *Am J Ophthalmol*. 2009;
- [8]. Shelsta HN, Jampol LM. Pharmacologic therapy of pseudophakic cystoid macular edema: 2010 update. *Retina*. 2011.
- [9]. Nicoară SD. Spectral Domain Optical Coherence Tomography in the Diagnosis and Monitoring of Diabetic Macular Edema. In: *OCT - Applications in Ophthalmology*. 2018.
- [10]. Liu Y, Simavli H, Que CJ, Rizzo JL, Tsikata E, Maurer R, et al. Patient characteristics associated with artifacts in spectralis optical coherence tomography imaging of the retinal nerve fiber layer in glaucoma. *Am J Ophthalmol*. 2015;
- [11]. Stock RA, Galvan DK, Godoy R, Bonamigo EL. Comparison of macular thickness by optical coherence tomography measurements after uneventful phacoemulsification using ketorolac tromethamine, nepafenac, vs a control group, preoperatively and

- postoperatively. Clin Ophthalmol. 2018;
- [12]. Anand AF, Kakkanatt CVA, T. Mathai M, Sasikumar M. Influence of cataract and small incision cataract surgery on the macular thickness measurements: an optical coherence tomography-based study. Int J Res Med Sci. 2018;
- [13]. Biro Z, Balla Z, Kovacs B. Change of foveal and perifoveal thickness measured by OCT after phacoemulsification and IOL implantation. Eye. 2008;
- [14]. Ramakrishnan Reshma SS. Comparison of central macular thickness after SICS and phacoemulsification cataract surgery, using Octe. Int J Ophthalmol Res. 2019;1(1):09–12.
- [15]. Matai DVJVDHD. Analysis of Macular Thickness by Optical Coherence Tomography (OCT) after 1 Month in Post-Operative Patients of Cataract Surgery. Int J Sci Res. 2018;
- [16]. Gharbiya M, Cruciani F, Cuzzo G, Parisi F, Russo P, Abdolrahimzadeh S. Macular thickness changes evaluated with spectral domain optical coherence tomography after uncomplicated phacoemulsification. Eye. 2013;
- [17]. Akarsu Acar OP, Olgun A, Ergen E, Demir AG, Guven D. Evaluation of Changes in Macular Thickness Using Optical Coherence Tomography After Cataract Surgery in Diabetic and Nondiabetic Patients. J Acad Res Med. 2019;

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