

## ORIGINAL RESEARCH

## CORNEAL TOPOGRAPHICAL COMPARISON PRE AND POST-PHACOEMULSIFICATION

Dr Bhavya Jad<sup>1</sup>, Dr Ashok K Sharma<sup>2</sup><sup>1</sup>Post-Graduate, <sup>2</sup>Professor and Head, Upgraded Department of Ophthalmology, GMC Jammu,**Corresponding Author**

Dr Bhavya Jad Post-Graduate, Upgraded Department of Ophthalmology, GMC Jammu

Received: 23 December, 2022

Accepted: 10 January 2023

**Abstract****Aim:** To determine the corneal changes after phacoemulsification on corneal topography.**Material and Methods:** The present hospital-based prospective, longitudinal, interventional study conducted on 90 patients who underwent uncomplicated phacoemulsification in the Upgraded Department of Ophthalmology Government Medical College, Jammu from 1<sup>st</sup> November 2020 to 31<sup>st</sup> October 2021.**Results:** In this study the mean K1 value pre operatively was  $42.30 \pm 1.36D$  and at 3 months was  $42.22 \pm 1.32D$ . The mean K2 value pre operatively was  $42.98 \pm 1.38D$  and at 3 months was  $42.73 \pm 1.31D$ . The mean astigmatism pre operatively was  $0.68 \pm 0.45D$  and at 3 months was  $0.45 \pm 0.29D$ **Conclusion:** It concludes that the average astigmatism decreased gradually with increasing postoperative period and was statistically significant at 3 months with  $p < 0.001$ .**Keywords::** Keratometry, Phacoemulsification, Surgically induced astigmatism**Introduction**

Corneal topography is a non-contact imaging technique that maps the shape and features of the corneal surface. Corneal topographers such as a Placido disc, analyse the pattern of light rays reflected off the cornea and tear film-air interface and reconstruct the corneal shape.<sup>1</sup> The recent literature on corneal topographic evaluation of induced astigmatism after cataract surgery suggests that in general, smaller, temporal incisions result in less astigmatism. Corneal topography assessment has become increasingly important for surgical planning in patients scheduled for cataract surgery. One of the main reasons is the increased expectations for reduced spectacle dependence following cataract surgery.<sup>2</sup> The corneal refractive changes are attributed to the location and size of the corneal incision. Conventional temporal corneal tunnel phacoemulsification without sutures can produce with-the-rule astigmatism, because the corneal curvature at the meridian of the incision would be flattened.<sup>3</sup> IOL implantation guided by corneal topography with incision placed at the steepest corneal meridian can help diminish post op astigmatism.<sup>3</sup> Corneal topography helps in identifying pre-op astigmatism and refractive forces by topographic maps.<sup>5-8</sup> Therefore, the surgical technique is modified accordingly in order to achieve the most desirable result. The present study was intended to evaluate the corneal changes before and after phacoemulsification on corneal topography.

## Materials and Methods

This is a prospective, longitudinal, hospital based, analytical, interventional study conducted on the patients who underwent uncomplicated phacoemulsification in the Upgraded Department of Ophthalmology Government Medical College, Jammu from 1<sup>st</sup> November 2020 to 31<sup>st</sup> October 2021. This study was conducted after approval from the institutional ethics committee. Patients aged >40years those who are willing to participate in the study. Patients with post-operative complications any corneal opacity and eyelid disorders affecting the ocular surface were excluded from the study.

The study was carried out as follows: Topography was performed and six topographic images ensuring the following points were noted:

- Localized area of corneal steepening greater than 46.00D in the standard scale map.
- Differential profile map with steeper topographical pattern.
- Irregular astigmatism detection in the topographical map.

Phacoemulsification surgery was performed. All the surgeries were performed by a single surgeon. Post-operative assessment of the patients was carried out at 1 week and 3 months using corneal topography system to find out post-operative change in K1 and K2 values and astigmatism.

## Results

Table 1 shows distribution of topographic parameters of the patients. The mean K1 value pre operatively was  $42.30 \pm 1.36D$  and post operatively at 1 week was  $42.17 \pm 1.42D$  and at 3 months was  $42.22 \pm 1.32D$ . The mean K2 value pre operatively was  $42.98 \pm 1.38D$  and post operatively at 1 week was  $42.70 \pm 1.27D$  and at 3 months was  $42.73 \pm 1.31D$ . The mean astigmatism pre operatively was  $0.68 \pm 0.45D$  and post operatively at 1 week was  $0.57 \pm 0.39D$  and at 3 months was  $0.45 \pm 0.29D$  (Figure 1 and 2)

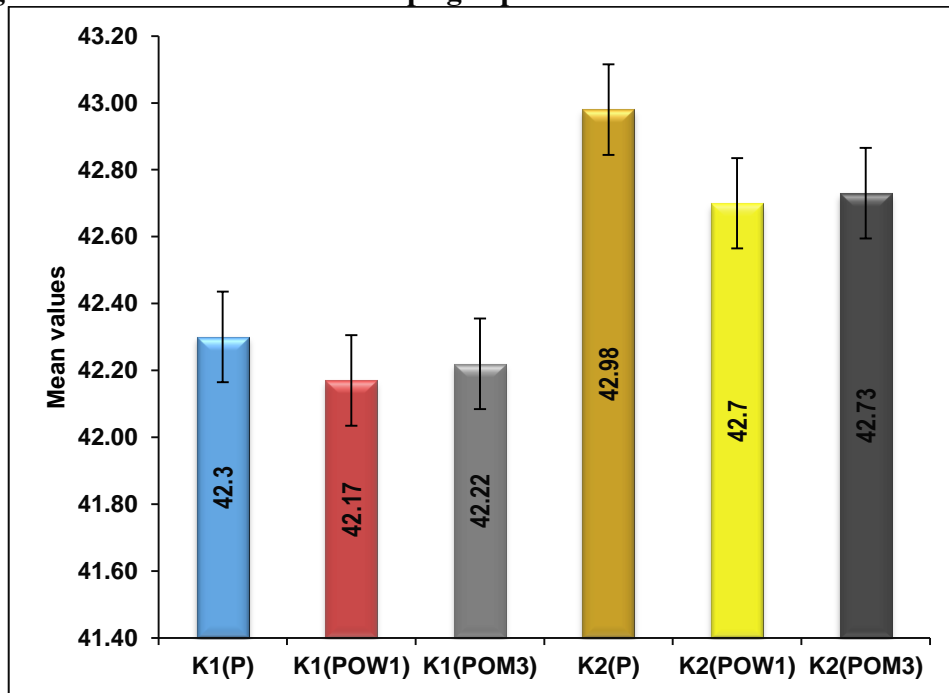
Table 3 shows the comparison of K1 pre operatively and post operatively at 3 months the difference mean was  $0.076 \pm 0.089$ , the t-value 0.850 and p-value 0.398 which was not statistically significant. On comparing K2 pre operatively and post operatively at 3 month the difference mean was  $0.249 \pm 0.093$ , the t-value 2.678 and p-value 0.009 which was statistically significant. On comparing astigmatism pre operatively and post operatively at 3 month the difference mean was  $0.231 \pm 0.056$ , the t-value 4.115 and p-value <0.001 which was statistically highly significant

**Table 1: Distribution of topographic parameters of the patients**

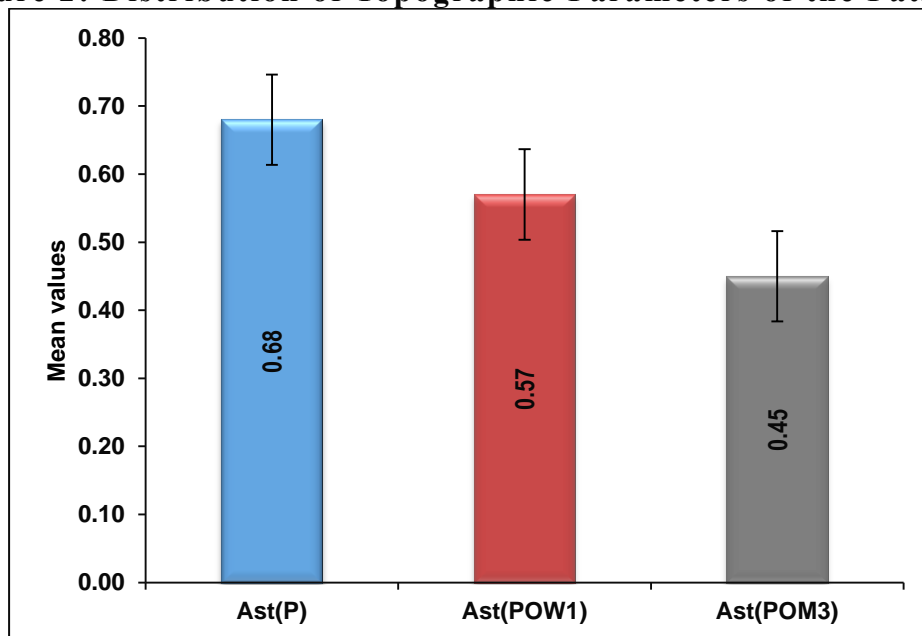
Variables	N	Mean	Std. Deviation (SD)	Minimum	Maximum
K1 (P)	90	42.30	1.36	39.10	45.86
K1 (POW1)	90	42.17	1.42	39.00	46.80
K1 (POM3)	90	42.22	1.32	39.70	46.00
K2 (P)	90	42.98	1.38	40.11	46.66
K2 (POW1)	90	42.70	1.27	40.00	46.50
K2 (POM3)	90	42.73	1.31	39.76	47.15
Ast (P)	90	0.68	0.45	.00	2.25
Ast (POW1)	90	0.57	0.39	.00	1.90
Ast (POM3)	90	0.45	0.29	.00	1.50

N=Number of patients; P=Pre-operatively; POW1=Post operatively at week 1; POM3=Post operatively at 3 months; Ast=Astigmatism

**Figure 1: Distribution of Topographic Parameters of the Patients**



**Figure 2: Distribution of Topographic Parameters of the Patients**



**Table 3: Comparison of Topographic Parameters of the Patients at Presentation (P) and Post-operatively at three Months (POM3)**

Variables	Difference Mean	Std. Error of Mean	95% Confidence Interval of the Difference Mean	t-value	p-value
K1 (P) - K1 (POM3)	0.076	0.089	-0.102 -0.254	0.850	0.398
K2 (P) - K2 (POM3)	0.249	0.093	0.064 - 0.434	2.678	0.009
Astig (P) - Astig (POM3)	0.231	0.056	0.119 - 0.343	4.115	<0.001

Astig (P)=Astigmatism at presentation; Astig (POM3) =Astigmatism postoperatively at 3 months.

### Discussion

Cataract remains the leading cause of blindness and low vision throughout the world despite advances in the technology and techniques for cataract surgery over the last three decades.<sup>3</sup> In cataract surgery, Phacoemulsification is the latest preferred technique due to the minimization of postoperative astigmatism and the rapid visual rehabilitation.<sup>5</sup>

In this study, before phacoemulsification 25 (27.78%) patients presented with astigmatism in the range of 0.26 - .50D followed by 22 (24.44%) in 0.51 – 0.75D and 14(15.56%) patients in the range of 0 - 0.25D. Maralaut et al.<sup>9</sup> reported that most patients had astigmatism of -1.50D (9 patients), -2.00D (7 patients), -1.00D (7 patients), -0.75 D (4 patients), -2.50D (2 patients) and -3.00 D (2 patients). The mean astigmatism range in our study was lower than the above quoted study. After phacoemulsification 37.78% presented with a reduced astigmatism value in the range of 0-0.25D followed by 32.22% in the range of 0.26 – 0.50D and 15.56% in the range of 0.51-0.75D. Maralaut et al. reported that post phacoemulsification 10 patients had astigmatism of -1.00D and 7 patients had astigmatism of -0.75 to -0.50D. The mean post-operative astigmatism range was lower in our study compared to the above quoted study.

In this study, the mean pre-operative astigmatism was  $0.68 \pm 0.45$  diopters. In the study by Maralaut et al. (2001) the mean pre-operative astigmatism was -1.05 D which was higher than our study. Likewise, Delfi et al.<sup>4</sup> reported that the mean pre-operative astigmatism was  $1.239 \pm 0.784$ D in ATR(astigmatism against the rule) group and  $0.923 \pm 0.681$ D in AWR(astigmatism with the rule) group respectively. Similarly, Martin R<sup>6</sup> noted mean pre-operative astigmatism was  $1.28 \pm 0.89$  diopters. The mean pre-operative astigmatism in the above quoted studies was higher than our study.

In this study, the mean astigmatism post operatively at one week was reduced to  $0.57 \pm 0.39$  diopters and after 3 months of phacoemulsification the mean astigmatism was  $0.45 \pm 0.29$  diopters. Thus there was reduction in mean astigmatism when comparing the preoperative value with postoperative value at 3 months with p value of <0.001 which was highly statistically significant. Delfi et al.<sup>4</sup> noted on the 7th day mean astigmatism of  $1.651 \pm 1.024$ D in ATR (astigmatism against the rule) group and  $1.271 \pm 0.099$  in AWR (astigmatism against the rule) group respectively with p=0.035, and on the 30th day the mean astigmatism of 0.382 diopters with p=0.052. This difference was not statistically significant. Martin R<sup>6</sup> noted 7th day post-operative astigmatism to be  $1.3 \pm 0.96$  diopters and after 3 months  $1.31 \pm$

1.03 diopters with p value of 0.932 which was not statistically significant. Thus our study showed statistically significant decrease in the mean post-operative astigmatism, whereas the above quoted studies did not show statistically significant decrease in mean astigmatism.

In this study on comparing the mean K1 value pre operatively to mean K1 value post operatively at 3 month the p value was 0.398 which was not statistically significant and on comparing K2 value pre operatively to mean K2 value post operatively at 3 month the p value was 0.009 which was statistically significant. Similarly, Martin R<sup>6</sup> in their study noted that while comparing mean K1 value pre operatively to mean K1 value post operatively at 3 month the p value was 0.879 which was not statistically significant and while comparing mean K2 value pre operatively to mean K2 value post operatively at 3 months, the p value was 0.943 which was also not statistically significant. In our study the comparison of preoperative K2 value to postoperative K2 value was statistically significant unlike the above quoted study. In reference to topographic findings, various corneal topographic indices like mean K1(D), mean K2(D) and astigmatism were altered post phacoemulsification which were noted in our study. It was also noted that there was a reduction in the mean astigmatism value post phacoemulsification due to on axis incision.

### Conclusion

The average astigmatism decreased gradually with increasing postoperative period and was statistically significant at 3 months with  $p < 0.001$ . It was concluded that cataract surgery using phacoemulsification was found to yield significant reduction in keratometric readings and corneal astigmatism and corneal topography helped in assessing these parameters.

### References

1. Drews, Robert C. Five-year study of astigmatic stability after cataract surgery with intraocular lens implantation: comparison of wound sizes. *Journal of Cataract and Refractive Surgery*. 2006; 26(2): 250-53.
2. Mamalis, Nick. Incision width after phacoemulsification with foldable intraocular lens implantation. *Journal of Cataract and Refractive Surgery*, 2006; 26(2): 237-41.
3. Resnikoff S, Pascolini D, Etya'ale D, Kocur I, Pararajasegaram R, Pokharel GP, Mariotti SP. Global data on visual impairment in the year 2002. *Bull World Health Organ*. 2004; 82(11):844-51.
4. Delfi, Lubis WF. Comparison of the keratometric value before and after phacoemulsification of senile cataract through clear corneal temporal incision. *Int J Med Res Health Sci* 2018;7: 42-46.
5. Evangelos P, Armenis J. Comparison of corneal topography in eyes before and one month after the phacoemulsification procedure. *Biomed J Sci Res* 2020;25:19541-45.
6. Martin R. Cornea and anterior eye assessment with placido-disc keratometry, slit scanning evaluation topography and scheimpflug imaging tomography. *Indian J Ophthalmol* 2018;66:360-66.
7. Martinez CE, Klyce SD. Corneal topography in cataract surgery. *Curr Opin Ophthalmol* 1996;7:31-38.
8. Rae RC, Joo CK. Effects of steep meridian incision on corneal astigmatism in phacoemulsification cataract surgery. *J Cataract Refract Surg* 2012;38:666-71.
9. Maralaut, Azhardin & Farida, Nida & Sari, Nurmila. (2020). The change of Astigmatism before and after phacoemulsification cataract surgery with temporal incision in senile cataract patients at RSUP Fatmawati year 2015 – 2016. *International Journal of Human and Health Sciences (IJHHS)*. 2020; 5: 234.