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RESEARCH ARTICLE

COMPARISON OF SURGICALLY INDUCED ASTIGMATISM BETWEEN 2.8 MM AND 3.2 MM SUPEROTEMPORAL CLEAR CORNEAL INCISION IN PHACOEMULSIFICATION

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ABSTRACT

Purpose: To compare surgically induced astigmatism between 2.8 mm and 3.2 mm superotemporal clear corneal incision in phacoemulsification with foldable intraocular lens implantation. ***Material and methods:*** A prospective study of 100 eyes of 100 patients undergoing cataract surgery were randomly divided in two groups of 50 each Group1-underwent phacoemulsification through 2.8 mm clear corneal inscision. Group II- patients underwent phacoemulsification through 3.2 mm clear corneal incision. Postoperative assessment visual acuity and keratometry was done at Day 1, week 1, week 6 and 3rd month. ***Results:*** Surgically induced astigmatism at month 3 was found to be higher in group II(0.39D =/-0.16D) than in group I (0.32D ± 0.22D), but the difference was not found to be statistically significant (P=0.07). ***Conclusion:*** Reducing the size of superotemporal clear corneal incision incision from 3.2 mm to 2.8 mm in phacoemulsification does not significantly reduce amount of surgically induced astigmatism.

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INTRODUCTION

Cataract surgery has witnessed rapid advancements since the days of sutured incision of intracapsular, extracapsular cataract extraction (ECCE), to the present day suture less incisions involving either small incision cataract surgery (SICS) or phacoemulsification. In 2010, cataract was responsible for 33.4 % of total blindness and 18.4 % moderate to severe visual impairment in the world (Khairallah *et al.,* 2015). As per National Program for Control of Blindness, the incidence of cataract in India is 0.4-0.5%; thus the number of new cases of cataract to be operated upon each year comes to be 6.15 million1. Phacoemulsification, introduced by Kelman in 1967, is one of the most important innovations in management of cataract employing a 2-3mm incision (Kelman, 1967). The advantages of phacoemulsification are small incisions, less surgically induced astigmatism, rapid patient mobilization and visual rehabilitation. Clear corneal incisions are preferred as they have excellent visualization, sparing of conjunctiva and lack of bleeding, less operation time, but it may cause postoperative astigmatism (Ramon and Dimitri, 2008). Modern techniques in cataract surgery aim to achieve optimum unaided visual acuity to fulfill the patient's expectations (Hawker *et al.,* 2005). Astigmatism is one factor that hinders us to achieve this goal. Surgically induced astigmatism is a known consequence of creating the incision necessary for cataract surgery. The control of corneal astigmatism during cataract surgery has been of increasing importance. Cataract surgery has now come closer to refractive surgery (Rosen *et al.,* 2012).

Different site and sizes of incision have been tried to reduce preexisting and postoperative astigmatism. It is estimated that approximately 70% of the general population has at least 1.00D of astigmatism and approximately 33% of patients undergoing cataract surgery (Ferrer and Mico, 2009). Uncorrected astigmatism could significantly affect patient's independence, quality of life, and well-being (Wolffson *et al.,* 2012). Surgically induced astigmatism is influenced by the size (Moon *et al.,* 2007), site (Altan *et al.,* 2007) and configuration (Altan *et al.,* 2007) of the incision, patient's age (Tadros *et al.,* 2004), wound healing and pre-existing astigmatism (Tejedor *et al.,* 2005). Among all these, the major factor responsible for postoperative astigmatism is size of clear corneal incision The incision size which earlier was 10-12 mm in ECCE has been cut down to about 5-6 mm in SICS & 2-3 mm in phacoemulsification. Small incision surgery shows rapid and stable optical recovery by preventing significant changes in corneal curvature. They have better intraoperative stability of anterior chamber, less postoperative intraocular inflammation, fewer incision related complications. Stabilization of SIA has been reported at 3 months following surgery (Wang *et al.,* 2012). Present study will be undertaken to compare surgically induced astigmatism in phacoemulsification with 2.8 and 3.2 mm clear corneal incision.

MATERIALS AND METHODS

The proposed prospective, comparative study was conducted on patients attending the OPD of Upgraded Department of

ophthalmology, Government medical college, Jammu with complaints of diminution of vision due to cataract from 1st November 2016 for a period of one year. The study was conducted on total of 100 patients (100 eyes) and cases were divided into two groups of 50 each.

Group I: comprised of 50 patients (50 eyes) who were operated by phacoemulsification with posterior chamber intraocular lens through 2.8 mm clear corneal incision.

Group II: comprised of 50 patients (50 eyes) who were operated by phacoemulsification with posterior chamber intraocular lens through 3.2 mm clear corneal incision.

Inclusion criteria

- Patient with senile cataract of grade I, II, III.
- Patient of either sex.
- Both unilateral and bilateral cataract.

Exclusion criteria

- Patients of senile cataract of grade IV.
- Patients with coexisting glaucoma, uveitis, pseudoexfoliation, subluxated lens, traumatic cataract, corneal opacity, exotropia, esotropia and high myopia.
- Patients with posterior segment pathology (Retinitis Pigmentosa, Retinal detachment, Age related macular degeneration, Diabetic Retinopathy, Hypertensive Retinopathy).
- Preexisting astigmatism >1D
- Detailed history pertaining to visual impairment and relevant medical history was recorded. A complete general physical examination to rule out any associated systemic disease was done. A detailed ocular examination including visual acuity and preoperative keratometry was done. Phacoemulsification was performed through a clear corneal superotemporal incision followed by foldable intraocular lens implantation .All the surgeries were performed by the same surgeon. Patients were followed up on first postoperative day, first postoperative week, sixth postoperative week and 3rd postoperative month In each visit visual acuity, slit lamp examination, keratometry and refraction was performed. Complications if any were also recorded. Both pre- and postoperative keratometric horizontal (K1) and keratometric vertical (K2) were measured by Bausch and Lomb Keratometer. Astigmatic magnitude was quantified in diopteres (D) and axis direction was depicted in degree. Results were analysed by vector analysis using SIA Calculator Version 2.1 (Sawhney and Aggarwal 2010).

RESULTS

Mean age of patients in Group I was 65.62 and in Group II was 63.96 years, the difference between the two was statistically not significant (p=0.21). Mean preoperative astigmatism in Group I was 0.8D with a range of 0 to 2.75 and in Group II was 0.83D with a range of 0 to 2.25, difference being statistically not significant (p=0.78). Mean values of SIA on day 1 was 0.59 with a range of 0.00 to 1.75 in group I (with 2.8 mm temporal clear corneal incision) and was 1.11 with a range of 0.50 to 2.25 in group II (with 3.2 mm temporal corneal incision), the difference being statistically highly significant (p<0. Mean SIA after 1stpostoperative week in Group I was 0.55, with a range of 0.00 to 1.75 and in Group II was 0.69 with a range of 0.00 to 1.75, the difference being statistically not significant (p=0.08). Mean SIA after six weeks of surgery in Group I was 0.34 with a range of 0.00 to 1.00 and in Group II was 0.40 with a range of 0.00 to 0.75, the difference being statistically not significant Mean SIA at the end of 3rd postoperative month in Group I was 0.32 with a range of 0.00 to 1.00 and in Group II was 0.39 with a range of 0.00 to 0.75, the difference not being statistically significant (p=0.07).

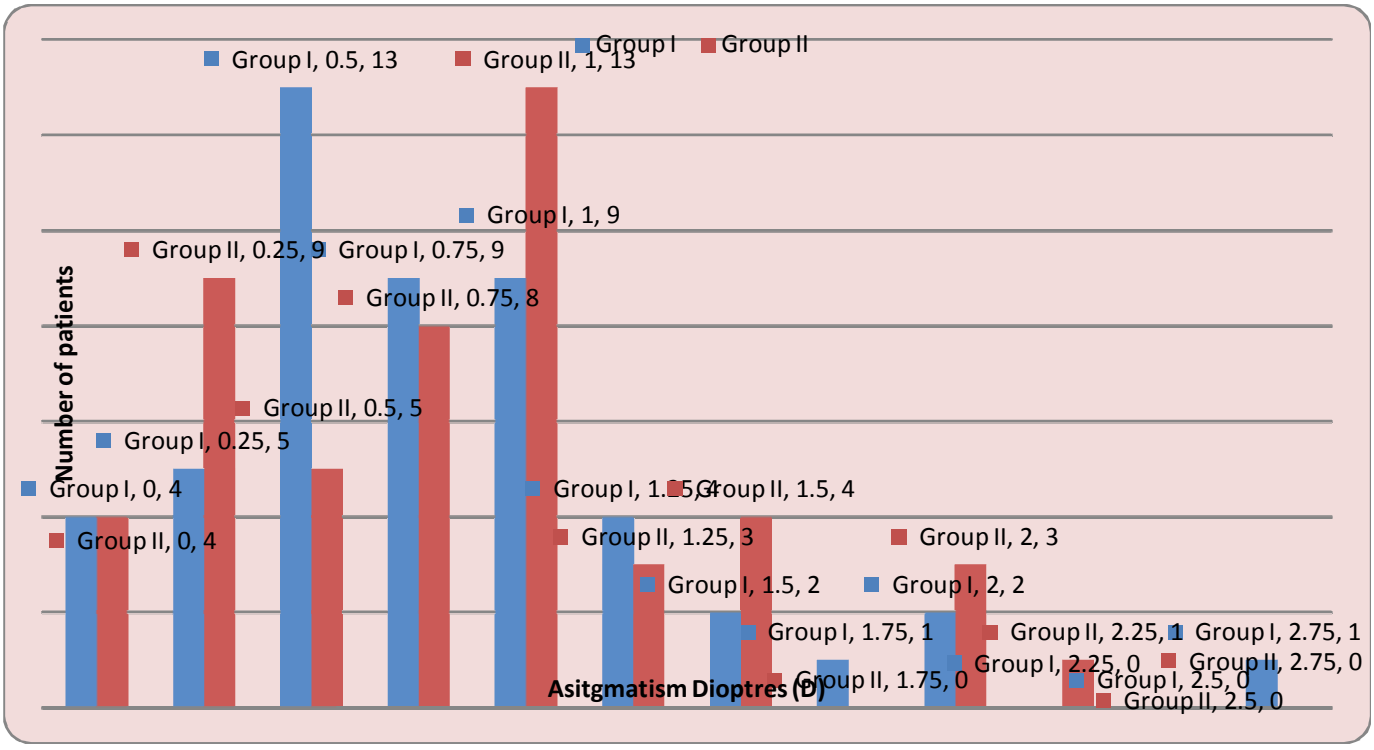

Fig. 1: Graph showing distribution of patients according to preoperative corneal astigmatism

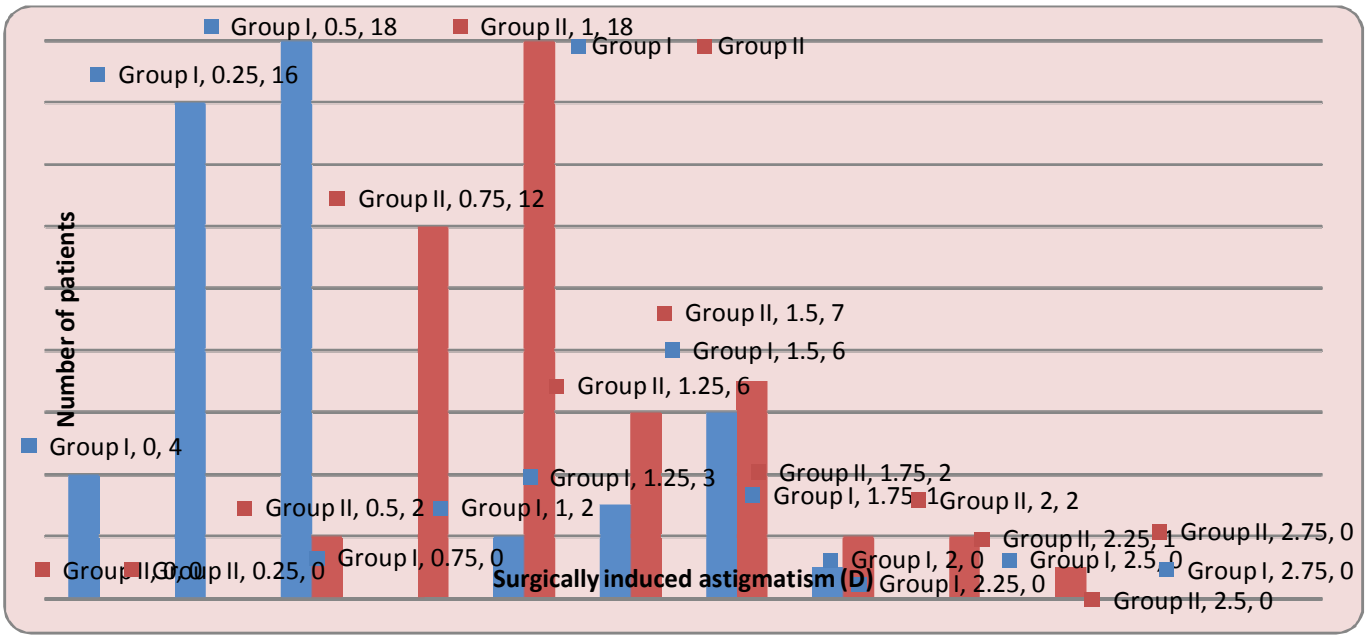

Fig. 2. Graph showing distribution of patients according to postoperative surgically induced astigmatism on day 1

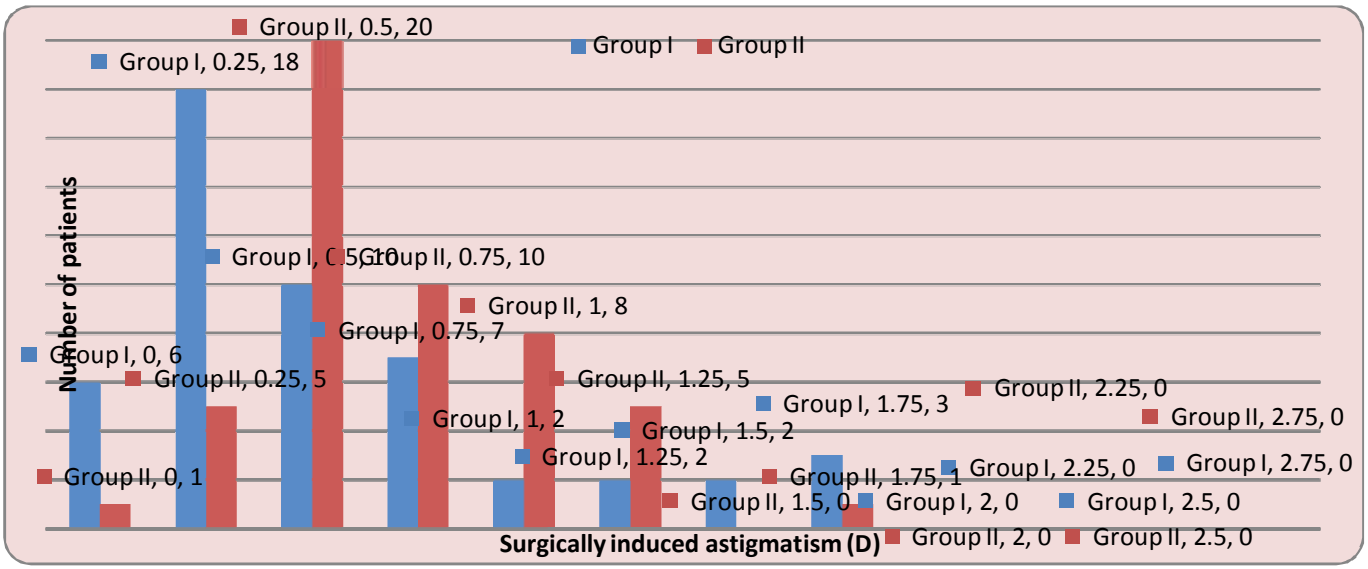

Fig. 3. Graph showing distribution of patients according to surgically induced corneal astigmatism on week 1

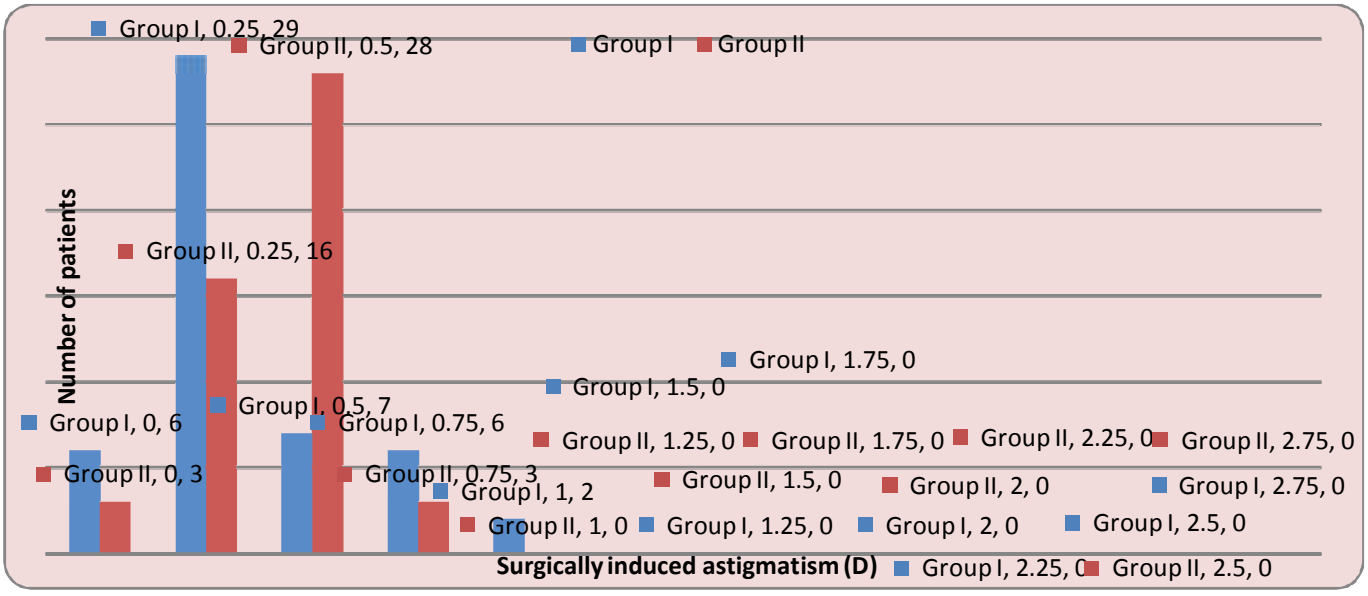

Fig. 4. Graph showing distribution of patients according to surgically induced corneal astigmatism on week 6

Table 1. Intragroup comparison of mean SIA (D) in two study group at different postoperative intervals

Postoperative intervals	Surgically induced astigmatism (D)	
	Group I Mean ± SD	Group II Mean ± SD
Day 1	0.59 ± 0.48	1.11 ± 0.38
Week 1	0.55 ± 0.47	0.69 ± 0.33
Week 6	0.34 ± 0.24	0.40 ± 0.17
Month 3	0.32 ± 0.22	0.39 ± 0.16
Statistical inference (One-way ANOVA)	F=6.53; p=0.0003; Highly significant	F=70.51; p<0.00001; Highly significant

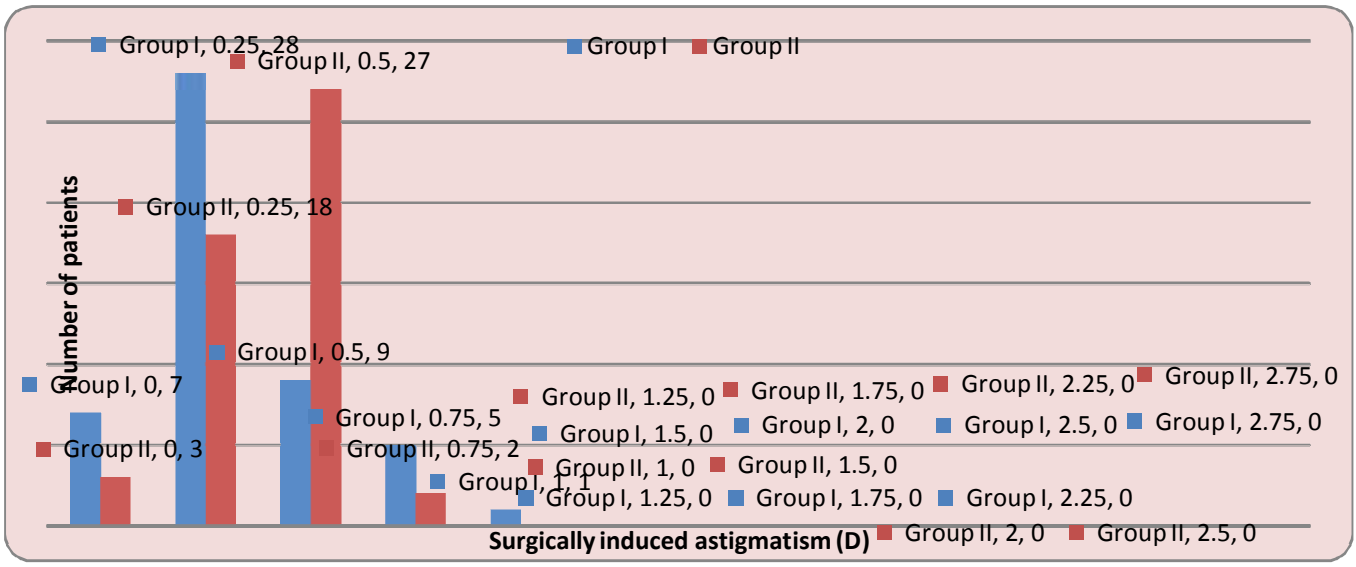

Fig. 5. Graph showing distribution of patients in two study groups according to surgically induced corneal astigmatism on 3 months

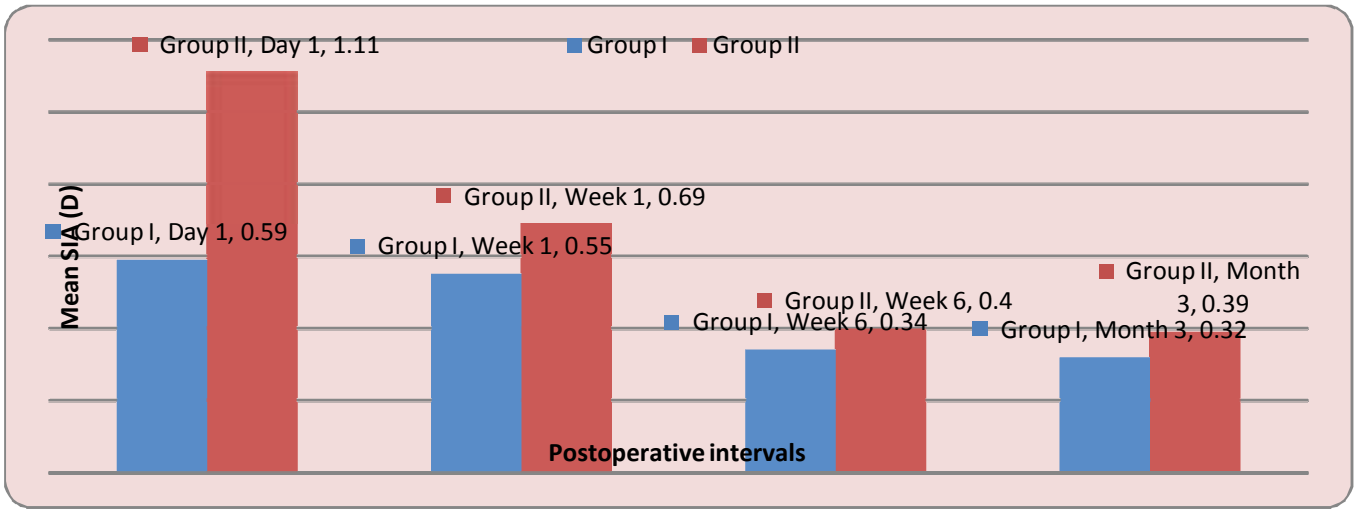

Fig. 6. Graph showing intragroup comparison of mean SIA (D) in two study groups at different postoperative intervals

Intragroup comparison of mean SIA (D) values from day 1 to month 3 in Group I showed highly significant improvement (p=0.0003). Similarly, mean SIA (D) values in Group II also showed highly significant improvement (p<0.00001). Statistically, more improvement was observed in Group II (64.86%) as compared to Group I (45.76%) from day 1 to month 3. SIA at end of our study was slightly higher in group II than group I, but the difference was statistically insignificant (P=0.07). Our findings are in general agreement with previously reported study given by Kocabora *et al.* (2010) where mean SIA was greater in phacoemulsification with 3.2 mm clear corneal incision group compared to 2.4 mm clear corneal incision group at 1st postoperative day. However, this difference diminished over the course of follow up, with similar mean SIA at 3 months Our resultsare also compatible with Yi-Hsuan *et al*., (2012) study where 3.5 mm incision grouphad larger SIA than the 2.5 mm group in the early postoperative period, but the difference became statistically insignificant (P<0.05) at 12 weeks and Musanovic *et al*., (2012) found that SIA of 3 mm incision was greater than SIA of 2.2 mm incision only at first postoperative day, but SIA was similar between the two groups at other follow ups.

DISCUSSION

The goal of modern modern day cataract surgery is to minimize postoperative corneal astigmatism for best visual outcome. This requires an exact evaluation of corneal curvature before and after surgery as the incisions may induce a variable amount of corneal astigmatism. Currently small

incision in phacoemulsification is preferred to minimize postoperative corneal astigmatism. In our study Surgically induced astigmatism on1st postoperative day was 0.59 ± 0.48D and 1.11 ± 0.38D in the group with 2.8 mm and 3.2 mm temporal CCI respectively. Mean SIA (D) values in both the groups showed gradual shift from higher degree of astigmatism on day 1 (0.59 ± 0.48D and 1.11 ± 0.38D) to lower degree of astigmatism on 3rd month (0.32 ± 0.22D and 0.0.39 ± 0.16D).

Conclusion

Our study demonstrated that coaxial phacoemulsification yielded satisfactory results with both 2.8 mm and 3.2 mm superotemporal clear corneal incisions. Both group experienced similar surgically induced astigmatism, except at 1st postoperative day, when SIA was greater in phacoemulsification with 3.2 mm clear corneal incision group compared to 2.8 mm clear corneal incision group. This difference diminished over the course of follow up at the end of 3 months, with no statistically significant difference with regards to visual outcome and postoperative complications in both the groups.

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