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ORIGINAL ARTICLE

SURGICALLY INDUCED ASTIGMATISM IN 2.8 MM, 5.3 MM PHACOEMULSIFICATION AND 6.0 MM MANUAL SMALL INCISION CATARACT SURGERY

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ABSTRACT: PURPOSE: To evaluate and compare the surgical induced astigmatism in Phacoemulsification done by 2.80 and 5.30 mm clear corneal incision and SICS done through superiorly placed 6.00mm scleral incision. **METHODS:** Group – 1:2.80 mm clear corneal, sutureless, temporally placed incision with phacoemulsification technique (PE); Group–2:5.30 mm clear corneal, sutureless, temporally placed incision with phacoemulsification technique (PE); Group–3: 6 mm, straight scleral, sutureless, superiorly placed incision with manual small Incision cataract surgery (MSICS). **RESULTS:** Keratometric Cylinder (KC): The KC at 1 day, 1 week, 1 month, 3 month, was 1.26±0.54, 1.03±0.44, 0.99±0.36, 0.92±0.36 in group – 1; 1.90±0.41, 1.53±0.29, 1.37±0.28, 1.37±0.28 in group – 2 and 1.62±0.56, 1.43±0.68, 1.23±0.56, 1.21±0.49 in group 3 respectively.; Surgical Induced Astigmatism (SIA): The SIA at 1 week, 1 month, 3 month, was 0.64 ± 0.32, 0.55 ± 0.31, 0.48 ± 0.32 in group – 1; 1.00 ± 0.40, 0.84 ± 0.39, 0.84 ± 0.39 in group – 2 and 1.49 ± 0.77, 1.39 ± 0.46, 1.37 ± 0.40 in group – 3 respectively. After analysis, statistically significant ($P<0.05$) difference noted in keratometric cylinder & SIA between Group – 1 v/s Group – 2, Group – 1 v/s Group – 3 and Group – 2 v/s Group – 3 from day 1 & subsequent follow up. The preoperative parameters i.e. UCVA, mean keratometry & keratometric cylinder between the three groups were comparable. There was no statistically significant difference found between three groups preoperatively. **CONCLUSION:** Phacoemulsification 2.80 mm clear corneal temporal incision cataract surgery induces least SIA postoperatively, 5.30 mm incision induces 2nd least SIA & 6.00 mm straight superior scleral manual SICS induces the maximum SIA among the 3 groups.

KEYWORDS: Phacoemulsification, Manual SICS, Keratometric cylinder, surgical induced astigmatism.

INTRODUCTION: Surgical induced astigmatism can be reduced by proper incision placement, small self-sealing incision and implanting foldable intra ocular lens. So in the modern era of small incision cataract surgery the patient dependence on spectacle can be eliminated by focusing on various parameters affecting surgical induced astigmatism like incision length, incision location, wound construction, use of suture technique. Incision length is one of the important factors affecting surgical induced astigmatism so by minimizing the length of incision, surgical induced astigmatism can be reduced.

To evaluate the surgically induced astigmatism in 3 different methods of cataract surgery we carried out this study.

MATERIALS AND METHODS: A randomized prospective clinical trial was done to evaluate and compare the surgically induced astigmatism in 2.8 and 5.30 mm clear corneal incision in

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phacoemulsification and SICS done through superiorly placed 6.00mm straight scleral incision. The study comprise of 75 eyes which were divided into three groups.

Group 1(25 eyes) - 2.80 mm clear corneal temporal incision.
Group 2(25 eyes) - 5.30 mm clear corneal temporal incision.
Group 3(25eyes) -6.00mm straight superiorly placed scleral incision.

INCLUSION CRITERIA:

- Age related senile cataract (upto NS - 3).
- No active ocular or systemic diseases.
- Patient willing for follow up for 3 months
- Keratometeric astigmatism ≤ 1.0D (WTR).

EXCLUSION CRITERIA:

- Patient with previous ocular surgeries (corneal refractive, trabeculectomy, pterygium excision etc.)
- Any corneal thinning disorder.
- Patients with higher grades of nuclear sclerosis (to keep uniformity in size & architecture of incision).
- Patients with Keratometric Astigmatism > 1.0D.
- Patients with Pterygium.
- Patients with ocular pathology which may cause poor postoperative outcome (glaucoma, ARMD etc.).

PRE-OPERATIVE EVALUATION:

- History of presenting complaints and any past medical history
- Uncorrected visual acuity (UCVA) was estimated using standardized Snellen's chart at six meter distance.
- Best corrected visual acuity (BCVA) was estimated using standardized Snellen's chart at six meter distance after best refractive correction, wherever refraction was possible
- Near vision was evaluated by near vision chart.
- Slit lamp examination was done to evaluate anterior segment & assess the type of lenticular opacity.
- Fundus examination was done with direct ophthalmoscope.
- Manual keratometry was done by Keratometer (Bausch & Lomb) and IOL Power Calculated by A-Scan.
- Intraocular pressure (IOP) was measured by Applanation tonometer.
- Following investigations were done –
  I. Random Blood Sugar
  II. Urine Albumin & Sugar
  III. B.P. & ECG.

Preoperative Instructions and Medications:

One day before the surgery antibiotic eye drops were instilled 4 times.

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Preoperatively mydriasis was achieved with instillation of tropicamide & Phenylephrine combination eye drop & flurbiprofen eye drops.

SURGICAL PROCEDURE:

GROUP 1: All cases were done under local anesthesia (peribulbar block). The eye cleaned with betadine and drape applied. A biplanar clear corneal incision was made at edge of vascular arcade. Ocular viscoelastic substance was injected into the anterior chamber. Continuous curvilinear capsulorrhexis was performed. Hydrodissection and hydrodelineation was done using ringer lactate solution. Phacoemulsification was performed. Viscoelastic substance was injected to inflate the capsular bag. Foldable single piece IOL was inserted. The viscoelastic substance was removed with irrigation and aspiration. The anterior chamber was formed with ringer lactate solution and the wound hydrated to make a self-sealing one and checked for any leakage. No suture was applied.

GROUP 2: Same steps as in group 1 till viscoelastic substance injection to inflate the capsular bag. Thereafter the clear corneal incision was enlarged to 5.30 mm and then through this a rigid single piece PMMA lens (optic size = 5.25mm) was introduced into the capsular bag. The viscoelastic substance was removed with irrigation and aspiration. The anterior chamber was formed with ringer lactate solution and the wound hydrated to make a self-sealing one and checked for any leakage. No suture was applied.

GROUP 3: All cases were done under local anesthesia (peribulbar block). The eye cleaned with betadine and drape applied. Superior rectus suture was taken to ensure proper exposure of the sclera. A limbus based conjunctival flap was taken superiorly to get sufficient exposure of the bare sclera. Wet cautery was done to ensure hemostasis. A straight, partial thickness, bare scleral incision 6mm long was made 2 mm posterior to the limbus. Then at the depth of the initial incision sclera was dissected along its curvature till limbus is reached thereafter cornea was dissected to obtain a scleral-corneal tunnel. A side port was made at 10'o clock position. Ocular viscoelastic substance was injected into the anterior chamber through the side port. Continuous curvilinear capsulorrhexis was performed. Then entry into the anterior chamber was done through the scleral tunnel. Hydrodissection and hydrodelineation was done using ringer lactate solution. With the help of wire vectis lens was taken out. Rigid PMMA IOL was introduced into the capsular bag. The viscoelastic substance was removed with irrigation and aspiration. The anterior chamber was formed with ringer lactate solution and incision checked for any leakage. No suture was applied. Conjunctival flap was covered over the scleral incision and subconjunctival antibiotic injection given.

Postoperative management:

- Patients were advised for caution during early postoperative period and not to rub or apply excessive pressure to their operated eyes.
- Topical antibiotic drops (Moxifloxacin 0.5%) every 6 hour per day for 4 weeks.
- Topical steroid drops (Prednisolone acetate 1%) every 6 hour per day for 2 weeks and then tapered over next 4 weeks.
- Topical NSAID drops (flurbiprofen 0.03 %) every 6 hour per day for 4 weeks.
- Topical cycloplegics (Tropicamide 1%) twice a day for 3 weeks.

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Postoperative Evaluation:

Following postoperative parameters were assessed for all patients on day 1, 1 week, 1 month, 3 month postoperatively.

- UCVA using standardized Snellen's chart at six meter distance.
- BCVA using standardized Snellen's chart at six meter distance after best refractive correction (only at 3 months)
- Slit lamp examination was done to evaluate anterior segment
- Fundus evaluation was done with Direct Ophthalmoscope
- Intraocular pressure measurement using Applanation tonometer
- Manual keratometry by Keratometer (Bausch and Lomb)

STATISTICAL ANALYSIS: Data was recorded on a pre-designed proforma. Variables were assessed for approximate normality and then were summarized by mean and standard deviation.

Comparison between groups was done at each point of time by using "independent t – test". SPSS (0.0 statistical software was used for) data analysis. In this study P value of less than 0.05 was considered statistically significant.

OBSERVATION & RESULTS:

Pre-operative Parameters: The Preoperative parameters between the three groups were comparable. There was no statistically significant difference found between three groups preoperatively.

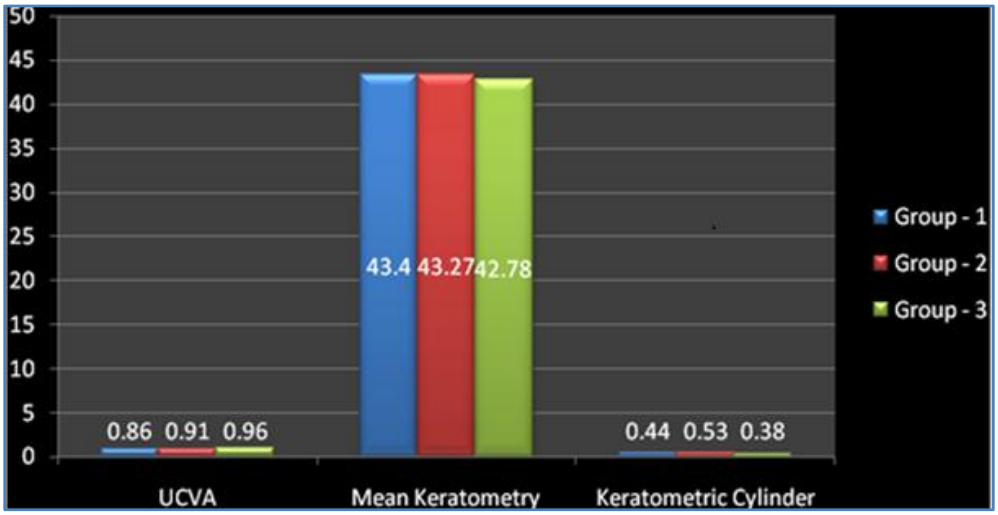

Figure 1: Pre-operative Parameters

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Keratometric cylinder:

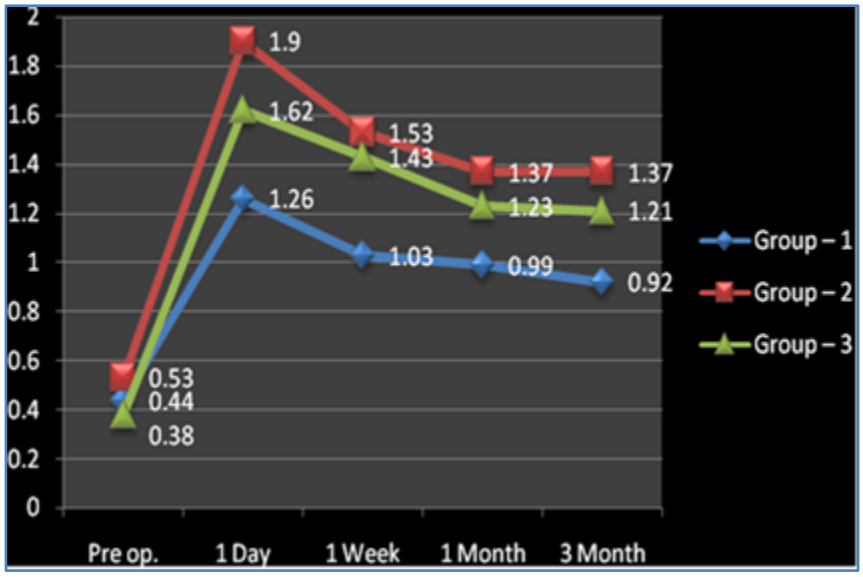

Figure 2: Keratometric Cylinder group 1 v/s group 2 v/s group 3

At day 1 & subsequent follow ups, statistically significant difference was noted between group – 1 & group – 2 ($P<0.05$) & Group – 1 and Group – 3 ($P<0.05$) whereas algebraically no statistically significant difference was noted between group – 2 and group – 3 ($P>0.05$) but by vector analysis statistically significant difference noted as majority of group 2 patients had WTR astigmatism whereas majority of group 3 patients had ATR astigmatism.

Surgical Induced Astigmatism (SIA): Surgical Induced Astigmatism was calculated using vector analysis 10-0 step formula given by Holladay, Cravy & Koch. The SIA was calculated using keratometry value by manual keratometer.

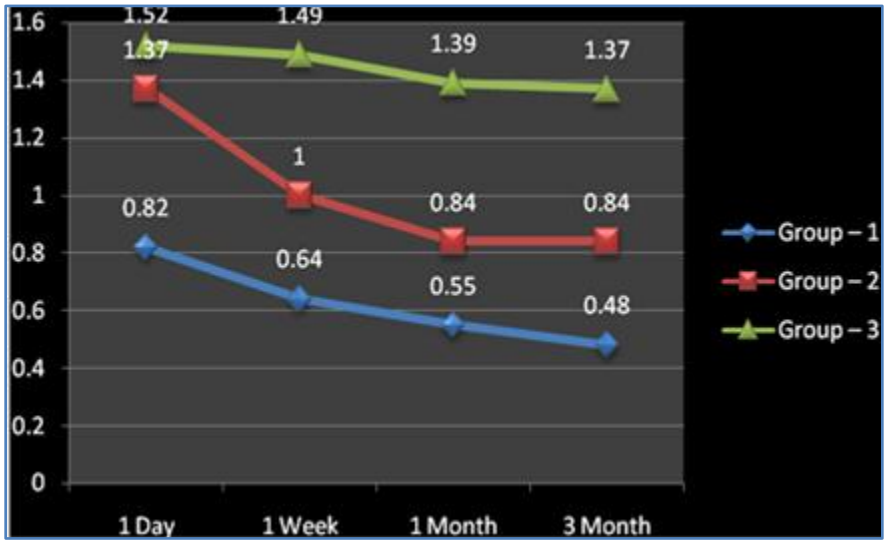

Figure 3: SIA group 1 v/s group 2 v/s group 3

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After analysis, statistically significant (P<0.05) difference noted in SIA between Group – 1 v/s Group – 2, Group – 1 v/s Group – 3 and Group – 2 v/s Group – 3 from week 1 & subsequent follow up.

DISCUSSION: Phacoemulsification surgery: Group 1 (Phaco/2.80mm/Temporal)

In the current study, surgical induced astigmatism one week after phacoemulsification (Group 1) was 0.64 D.

Mohammed Pakravan et al[1] (3.2 mm) reported figures of 0.71 D; Kohnen and associates[2] (3.2 mm) reported SIA figures of 0.62 D 2 week postoperatively; Gross RH, Miller KM[3] (3.2-3.5 mm) reported SIA figures of 0.74 D; Masket S[4] (3 mm) reported SIA figures of 0.46 D 1st week & 0.52 D 2nd week; Oshika T[5] (3 mm) reported SIA figures of 0.31 D; Phleger T et al[6] (3 mm) reported SIA figures of 0.43 D; Nielsen PJ[7] (3.5 mm) reported SIA figures of 0.55 D POD1.

In our study, SIA 4 weeks after surgery was 0.55 D.

Mohd. Pakravan et al[1] reported figures of 0.63 D; Barequet et al[8] reported very close figures of 0.74 D after 6 week; Gross RH, Miller KM[3] (3.2-3.5 mm) reported SIA figures of 0.60 D after 6 weeks; Masket S[4] (3 mm) reported SIA figures of 0.49 D after 6 weeks; Nielsen PJ[7] (3.5 mm) reported SIA figures of 0.55 D after 3 weeks & 0.46 D after 6 weeks; Oshika T[5] (3 mm) reported SIA figures of 0.22 D after 4 weeks; Phleger T et al[6] (3 mm) reported SIA figures of 0.22 D after 4 weeks.

In our study, SIA 3 months after surgery was 0.48 D.

Simşek S et al[9] reported SIA figures of 0.62 D after 3 months**;**Kohnen & associates[2] reported figures of 0.47 D after 6 months**;** Mohd. Pakravan et al[1] reported figures of 0.26 D at 6 months; Oshika T [5] (3 mm) reported SIA figures of 0.19 D after 4 weeks.

Very few studies have been found in literature in which average keratometric astigmatism readings were documented (in the phaco 2.8mm clear corneal temporal incision) but quite a few studies have been found in literature in which surgical induced astigmatism readings were documented.

During intermediate follow up, the average keratometric astigmatism readings and surgical induced astigmatism readings in our study did not match completely with other studies. This was due to variation in wound healing properties of subjects. But at the final follow up our study results matched with most of the other studies.

Phacoemulsification surgery: Group 2 (Phaco/5.30mm/Temporal)

In the current study, surgical induced astigmatism one week after Phacoemulsification cataract surgery (Group 2) was 1.00D, one month after surgery was 0.84D and 3 months after surgery was 0.84D. No previous similar study done.

SIA in group 2 less than group 3 in our study because of lesser incision size, variability in depth of sclera corneal tunnel incision and dissection during SICS which usually affects sclerocorneal flap apposition & thus higher SIA in group 3.

Manual Small incision cataract surgery: Group3 (SICS/6.00mm) (superior scleral).

In the current study, surgical induced astigmatism one week after small incision cataract surgery (Group 3) was 1.49D, one month after surgery was 1.39D and 3 months after surgery was 1.37D.

Same pattern was seen in studies by Nikhil S. Gokhale and Saurabh Sawhney[10] (2003); Parikshit Gogate et.al.,[11]; Ronnie George et al,[12]; Bhaskar Reddy, Amit Raj, Virender Pratap Singh[13]

who found that the mean surgically induced astigmatism in MSICS at the end of 3rd post-operative month, was 1.36D, 1.5D, 1.17D, 1.92D respectively.

During intermediate follow up, the average keratometric astigmatism readings and surgical induced astigmatism readings in our study did not match completely with other studies. This was due to variation in wound healing properties of subjects. But at the final follow up our study results matched with most of the other studies.

CONCLUSION: Phacoemulsification 2.80 mm clear corneal temporal incision cataract surgery induces least SIA postoperatively, 5.30 mm incision induces 2nd least SIA & 6.00 mm straight superior scleral manual SICS induces the maximum SIA among the 3 groups.

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