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ORIGINAL RESEARCH

A study to evaluate the anatomical and functional outcomes post small incision cataract surgery performed at tertiary care centre

[1]Dr. Chander Mohan Kohli, [2]Dr. Avaneesh Singh, [3]Dr. Priya Bansal

[1-3]Department of Ophthalmology, HIMS, Sitapur, India

Corresponding Author
Dr. Priya Bansal
Department of Ophthalmology, HIMS, Sitapur, India
Email: priya.bansal8979@gmail.com

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ABSTRACT

Introduction- Over the past decade, manual small incision cataract surgery, or MSICS, has gained popularity in India. Additionally, economical, MSICS eliminates the need to pay for the phacoemulsification machine's acquisition and upkeep. It is claimed that MSICS, in which the nucleus is administered via a 6-6.5 mm scleral tunnel, offers benefits to cataract blind patients that are comparable to those of phacoemulsification. Additionally, MSICS is simpler to learn than phacoemulsification for a surgeon with training in Extracapsular Catheter Extraction (ECCE) surgery. So, the goal of the current investigation is to assess the functional and anatomical results following MSICS. **Method-** A prospective and observational study was conducted including 200 patients attending the ophthalmology department post cataract (SICS) surgery, performed at tertiary care centre, Sitapur, after considering the inclusion and exclusion criteria. Using the patient's discharge card, pre-operative and demographic information was noted. Post-operative ocular results, such as visual acuity, anterior segment assessment, fundus examination, and IOP at post-1 week and 6 weeks, were documented for up to 6 weeks of follow-up. **Results-** After the surgical treatment, the UCVA and BCVA were, respectively, 55% and 92% after 6 weeks. A statistically significant change was seen in the K1 and K2 levels between pre-operative and 6-week post-operative values. When comparing the kind of astigmatism, there was a statistically significant change (p=0.032) between baseline and six weeks post-operative surgery. Six weeks after surgery, the mean SIA value was 1.28±0.7. **Conclusion-** This study demonstrates that posterior chamber intraocular lens implantation with SICS can result in a favourable visual outcome with a low risk of complications (as defined by the World Health Organisation, 6/6–6/18). Therefore, SICS may be used securely and confidently to achieve vision rehabilitation, particularly when the individual is from a low socioeconomic group and the locality has few services.

Keywords- manual small incision cataract surgery; India; phacoemulsification; cataract; vision rehabilitation; low socioeconomic group.

INTRODUCTION

Cataract is a partial or total clouding of the lens that causes decrease of visual acuity.[1] It is one of the leading causes of treatable blindness, contributing to 66.2% of the estimated 50 million cases of preventable blindness. [2] Recent decades have witnessed technological advances in cataract surgery and transition from intra capsular cataract extraction to phacoemulsification and small incision cataract surgery with intraocular lens (IOL) implantation, and more recently, femtosecond laser assisted cataract surgery. Phacoemulsification is the preferred surgical technique in developed countries. In a study done by Dervenis N et al it was found that visual acuity improved significantly post phacoemulsification.[3] The use of Small-incision cataract surgery (SICS) has been growing rapidly , and is the mainstay in the developing world because the technique is less expensive in terms of capital equipment investment, equipment maintenance costs, and consumables costs per procedure.[4] Furthermore, SICS has been shown to be a quicker procedure, with comparatively shorter learning curve [5]. SICS has emerged as a popular procedure of choice in the surgical treatment of cataracts as it is less expensive and is as effective as phacoemulsification [6]. Senile cataract is an age

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related, vision impairing disease characterized by gradual, progressive thickening of the lens. It is one of the world's leading causes of avoidable blindness [7]. The advent of small incision cataract extraction has greatly increased the safety and control of the procedure [8-11]. However, complications occur even in experienced hands, especially in complicated cases. Phacoemulsification is safer in eyes with soft or moderately hard nuclei than in those with dense and over-mature cataract. It is tempting to perform surgery during the earlier phases of the cataract, even though the risk-to-benefit ratio of cataract surgery may be higher. How early the surgeon should operate is determined by the impact of the procedure on the patient's daily life activities. Thus, it would be beneficial to ascertain all possible vision-related functions of daily life and use these, rather than only Snellen visual acuity and surgically induced astigmatism (SIA), to determine surgical outcome. In a study done by Zafar S et al., [12] it was reported that resident performed SICS had 9.1% of intra – operative complications and 18.2% of post operative complications after 4 months of follow up and improved visual acuity was seen in 95.2% of cases. It another study SICS had overall 2.60% intraoperative complications and post – operative complications rate was 1.78% [13].

So, the present study was undertaken with aim to evaluate the postoperative anatomical and functional outcomes of SICS performed at tertiary care centre.

MATERIAL & METHODS

A prospective and observational study was conducted including 200 patients attending the ophthalmology department post cataract (SICS) surgery, performed at tertiary care centre, Sitapur, after considering the inclusion and exclusion criteria.

METHODS OF STUDY

1. History and Pre – operative ocular findings
2. Post – operative ocular findings

i. Examination
ii. Slit lamp examination
iii. Record the intraocular pressure
iv. Indirect ophthalmoscopy
v. Follow – up

1. **History: -** Detailed history was taken which included Patient's particulars, systemic status of the patient and patient's demographic profile which was taken from the discharge summary.
2. **Patient's Pre – operative and demographic data was recorded using patient's discharge card –**

- Patient's particulars & Systemic status of the patient
- Pre-existing ocular conditions likely to influence either the operative course or the final visual acuity.
- Examination: Uncorrected visual acuity, Best-corrected visual acuity using Snellen chart.
- Findings of anterior segment & Posterior segment.
- The intraocular pressure: done by noncontact tonometry
- Axial length measurements and keratometry
- IOL power

3. **Post – operative ocular findings: -**

- **Examination**: - Check visual acuity
- **Slit lamp examination: -**Examination of the anterior segment.
- **The intraocular pressure**:- was recorded using Applanation Tonometry, Non-Contact Tonometry, digitally which when and where required.
- **Indirect ophthalmoscopy:**- was done to evaluate the Posterior Segment.
- **Follow – up:** Patient's data was recorded up to 6 weeks follow - up which included visual acuity, anterior segment evaluation, fundus examination, IOP at post 1 week and 6 weeks.

Statistical analysis: Data so collected was tabulated in an excel sheet, under the guidance of statistician. The means and standard deviations of the measurements per group were used for statistical analysis (SPSS 22.00 for windows; SPSS inc, Chicago, USA). Difference between two groups was determined using t test as well as chi square test and the level of significance was set at $p < 0.05$.

RESULTS

A prospective observational study was conducted including 200 patients attending the ophthalmology department post cataract (SICS) surgery, performed at tertiary care centre, Sitapur, after considering the inclusion and exclusion criteria. The written informed consent for clinical examination was obtained from patient/attendant. Of the 200 subjects included in the study, **maximum subjects were in age (TABLE-1 & FIGURE -1) range 61-70 years (51%),** followed by 44(22%) subjects>70 years of age, 31 (15.5%) subjects were 51-60 years of age and 23(11.5%) subjects were between 40-50 years of age. The minimum age of the included subjects was 46 years and maximum age was 83 years. In present study **maximum involved subjects were female (n=111, 55.5%)** and rest of the subjects were males (n=89, 44.5%)(TABLE-2 & FIGURE -2). Some of the subjects included in study had associated comorbidities like hypertension (n=42, 21%), diabetes (n=27, 13.5%) and other comorbid conditions (n=13, 6.5%)(TABLE-3 & FIGURE -3). Pre – operatively majority of patients had vision <6/60- >3/60 (n=143, 71.5%), followed by vision <6/18- >6/60 in 19% of patients, 9.5% subject had vision <3/60and there were no subjects with vision ≥6/18. The uncorrected visual acuity (UCVA)(TABLE-4 & FIGURE -4) pre-operatively in vision group ≥6/18 was 0%, in <6/18- >6/60 group was 19%, 71.5 % in <6/60- >3/60 group and 9.5% in <3/60group. The uncorrected visual

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acuity (UCVA) in vision group ≥6/18 was 34.5% at postoperative day 1, 42% at 1 week postoperatively and after 6 weeks was 55%. The UCVA in vision group<6/18- >6/60 was 60.5% at postoperative day 1, 53.5% at 1 week postoperatively and after 6 weeks was 44.5%. The UCVA in vision group <6/60- >3/60 was 4.5% at postoperative day 1, 4% at 1 week postoperatively and after 6 weeks was 0.5%. There was a statistically significant difference present between different intervals of post operative checkup (p<0.01). Pre – operatively majority of patients had severe vision impairment (n=155, 77.5%), followed by moderate vision impairment in 18.5% of patients, 4% subject of blindness and there were no subjects with mild vision impairment. The bestcorrected visual acuity (BCVA) in mild vision impairment group was 59.5% at postoperative day 1, 75.5% at 1 week postoperatively and after 6 weeks was 92%. The BCVA (TABLE-5 & FIGURE -5)in moderate vision impairment group was 28.5% at postoperative day 1, 22.5% at 1 week postoperatively and after 6 weeks was 7.5%. The BCVA in severe vision impairment group was 11% at postoperative day 1, 1% at 1 week postoperatively and after 6 weeks was 0.5%. There was a statistically significant difference present between different intervals of postoperative checkup (p<0.01). The preoperative K1 value was 44.16±1.62 and 6 weeks postoperative was 45.39±1.51, showing a statistically significant difference (p=0.037). The K2 value preoperative was 44.57±1.69 and 6 weeks postoperative was 45.48±1.55, showing a statistically significant difference (p=0.048). The distribution of baseline astigmatism was higher incidence of against rule astigmatism 50.5%, with rule astigmatism 39.5%, oblique astigmatism 6% and no astigmatism 4%.The distribution of postoperative astigmatism was higher incidence of against rule astigmatism 66%, with rule astigmatism 25.5%, oblique astigmatism 7.5% and no astigmatism 1%. There was a statistically significant difference present between baseline and 6 weeks after operative procedure, when type of astigmatism was compared (p=0.032)(TABLE6&FIGURE6). The mean value of SIA at 6 weeks post operatively was 1.28±0.7 (Table 7 & Figure7)

Table 1: Age distribution among the study subjects

Age Group (in years)	N	%
40-50	23	11.5
51-60	31	15.5
61-70	102	51
>70	44	22
Total	200	100

Table 2: Gender distribution among the study subjects

Gender	N	%
Male	89	44.5
Female	111	55.5
Total	200	100

Table 3: Co-morbidities among the study subjects

Co-morbidities	N	%
Diabetes	27	13.5
Hypertension	42	21
Others	13	6.5

Table 4: UCVA among the study subjects at different intervals

UCVA	Preop		POD-1		Week 1		Week 6	
	N	%	N	%	N	%	N	%
≥6/18	0	0	69	34.5	84	42	110	55
<6/18- >6/60	38	19	121	60.5	107	53.5	89	44.5
<6/60- >3/60	143	71.5	9	4.5	8	4	1	0.5
<3/60	19	9.5	1	0.5	1	0.5	0	0
p value	<0.01*							

*: statistically significant

Table 5: BCVA among the study subjects at different intervals

BCVA	Preop		POD-1		Week 1		Week 6	
	N	%	N	%	N	%	N	%
≥6/18	0	0	119	59.5	151	75.5	184	92
<6/18- >6/60	37	18.5	57	28.5	45	22.5	15	7.5
<6/60- >3/60	155	77.5	22	11	2	1	1	0.5

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<3/60	8	4	2	1	2	1	0	0
p value	<0.01*							

*: statistically significant

Table 6: Type of astigmatism at baseline after 6weeks of surgery

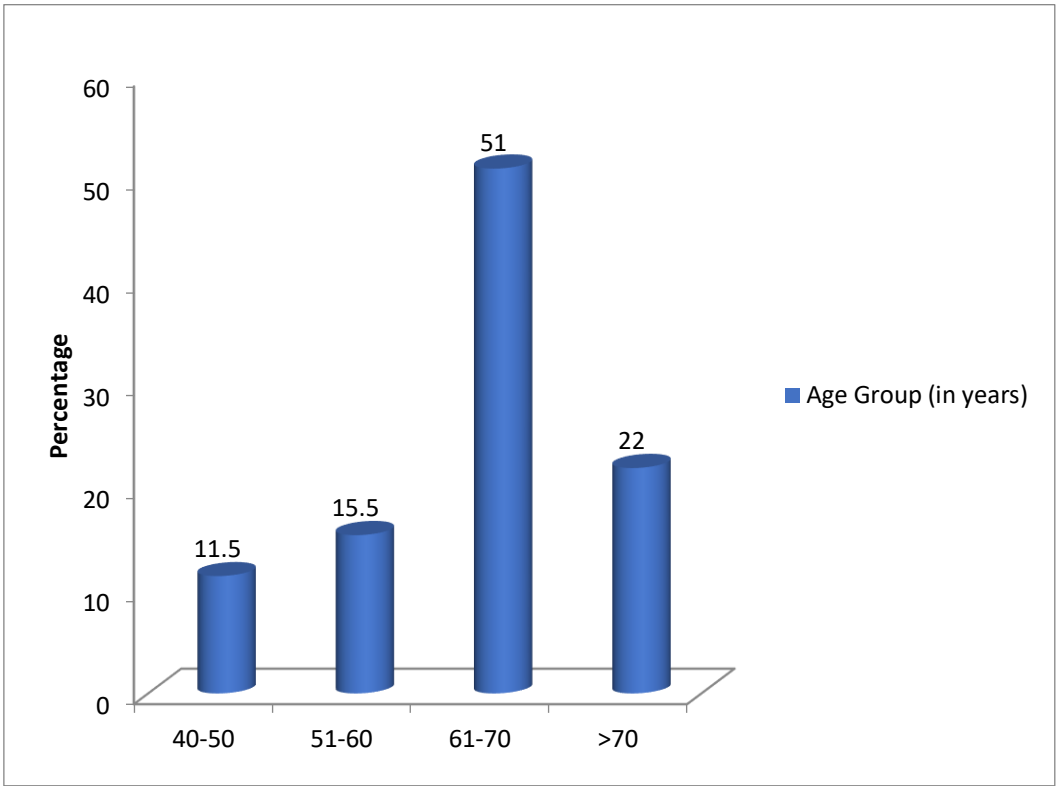
Type of Astigmatism	Baseline		After 6 Weeks of Surgery	
	N	%	N	%
With the Rule Astigmatism	79	39.5	51	25.5
Against the Rule Astigmatism	101	50.5	132	66
Oblique Astigmatism	12	6	15	7.5
No Astigmatism	8	4	2	1
Chi Square Test	8.93			
p value	0.032*			

*: statistically significant

Table 7: Surgical induced astigmatism (SIA) at 6 weeks

SIA	N	%
0-<0.5D	43	21.5
>0.5-<1.0D	106	53
>1.0-<1.5D	51	25.5
>1.5-<2/0D	0	0
>2.0D	0	0
Mean±SD	1.28±0.7	

The mean value of SIA at 6 weeks post operatively was 1.28±0.7. (Table 8)



Graph 1: Age distribution among the study subjects

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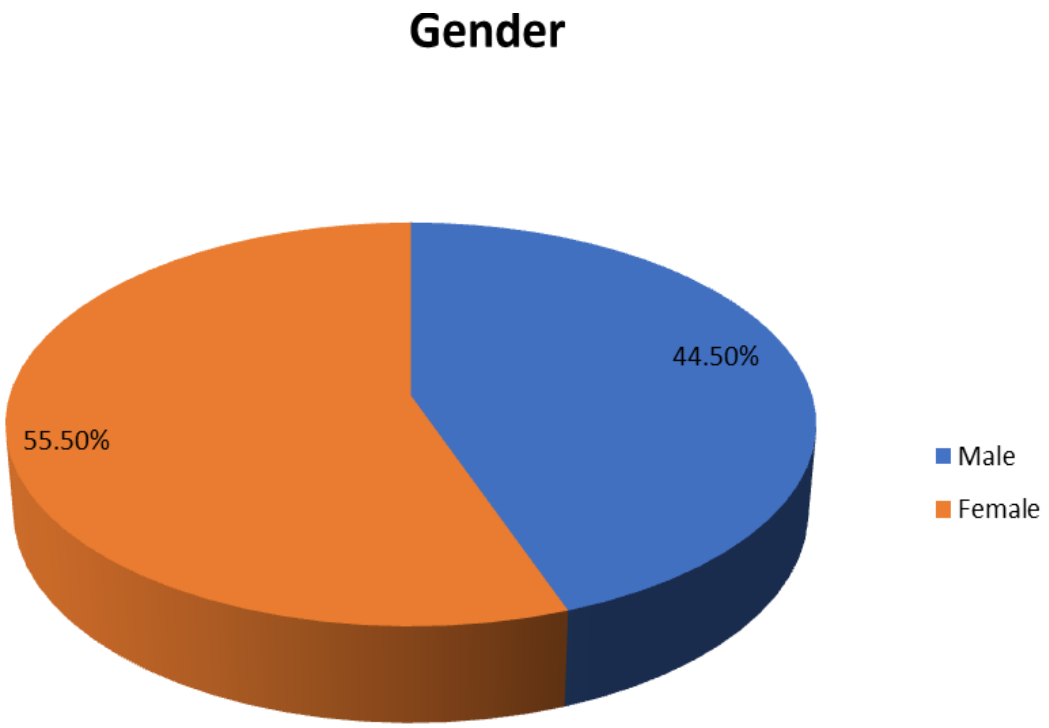

Graph 2: Gender distribution among the study subjects

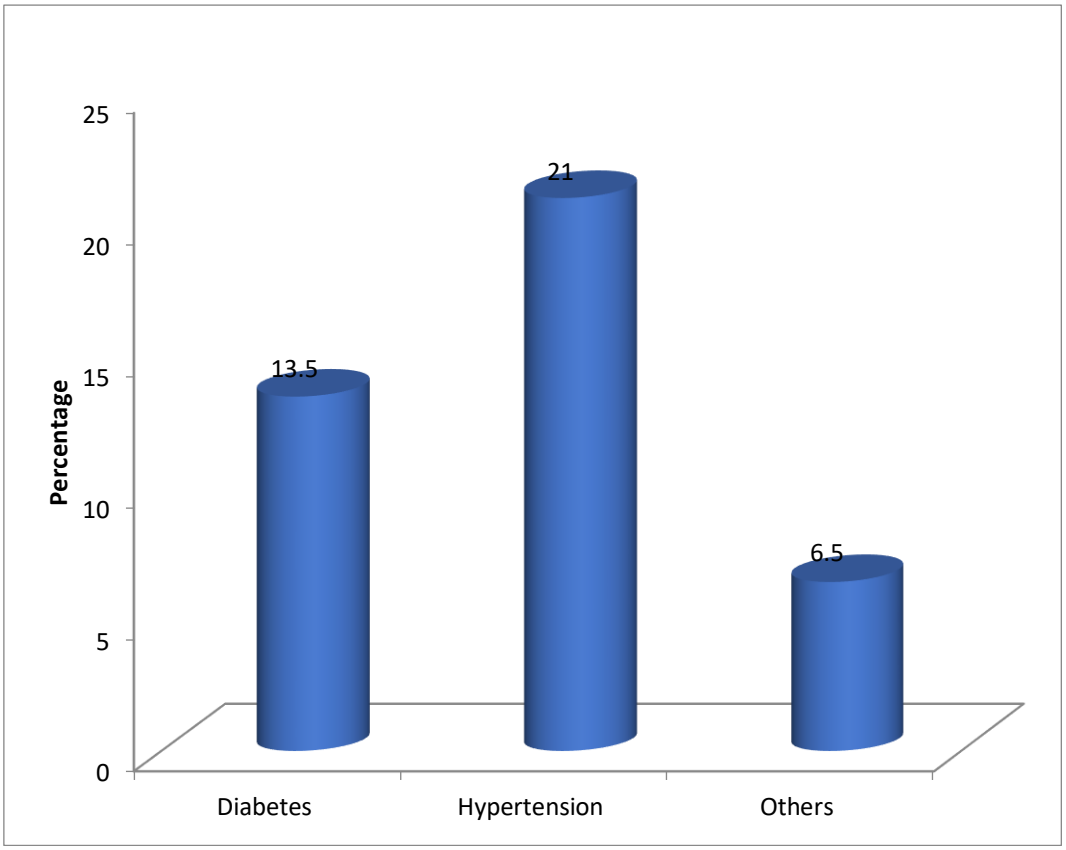

Figure 3: Co-morbidities among the study subjects

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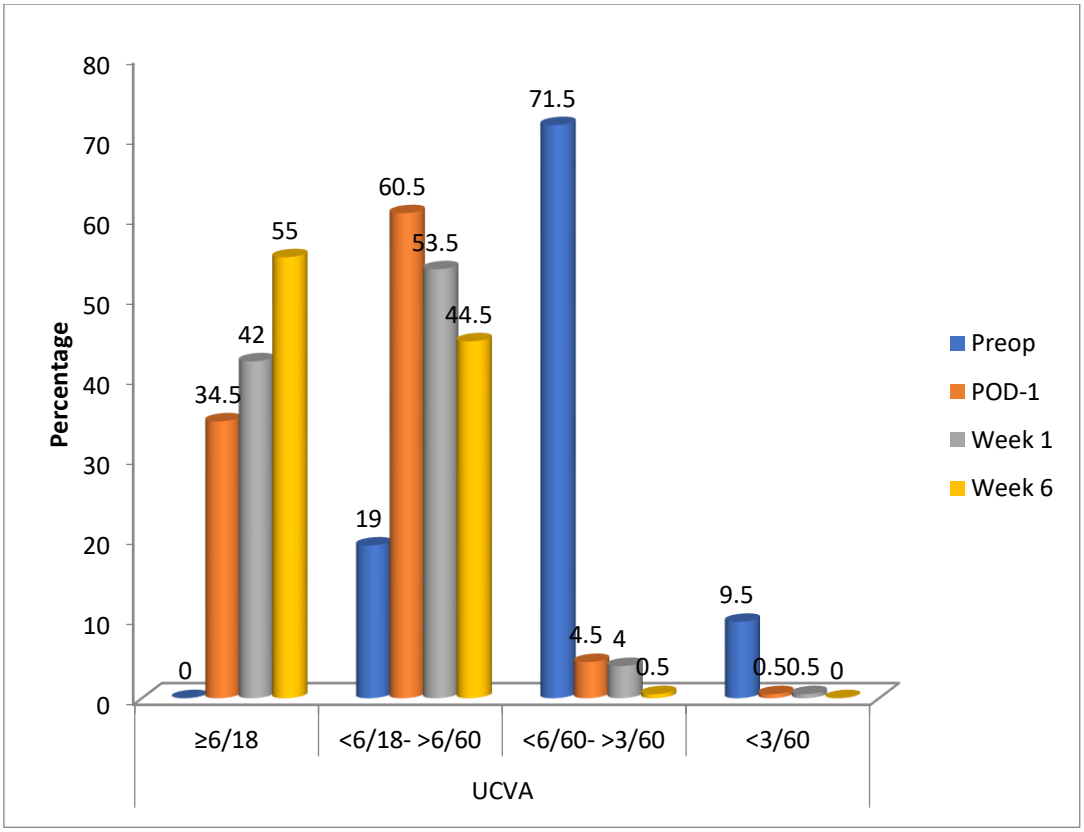

Figure 4: UCVA among the study subjects at different intervals

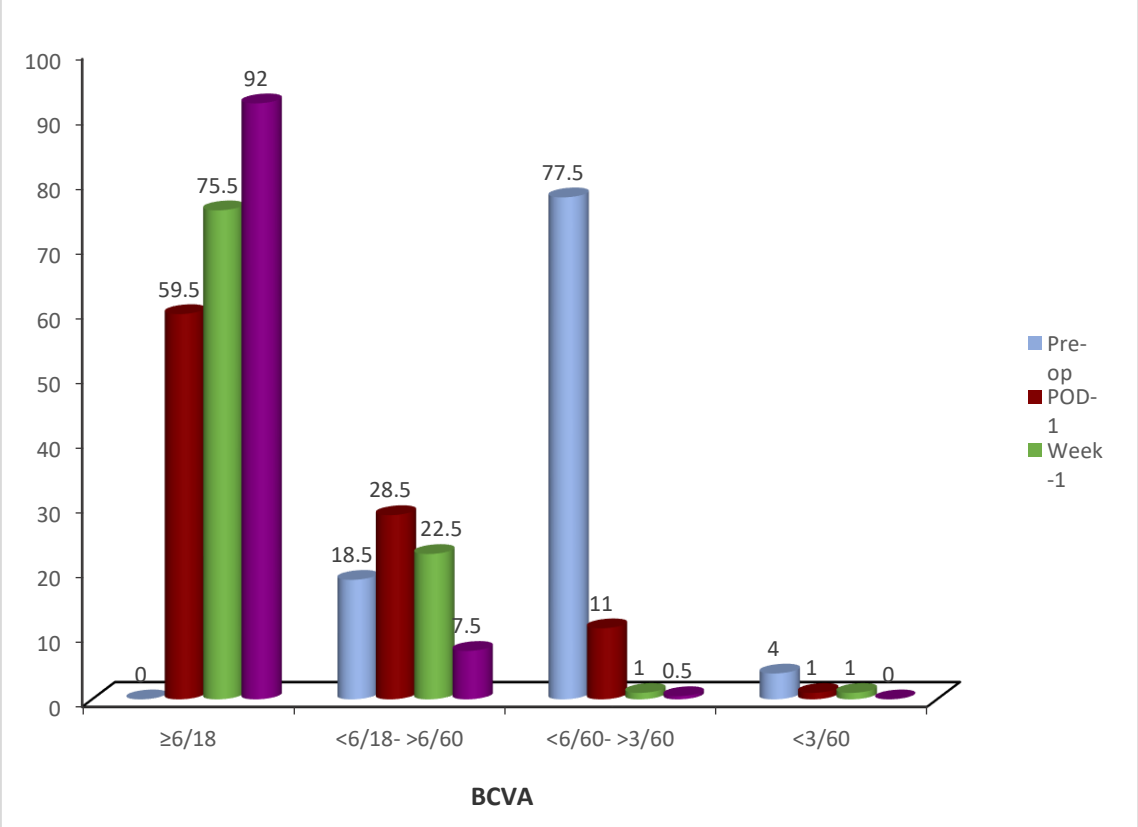

FIGURE 5: BCVA among the study subjects at different intervals

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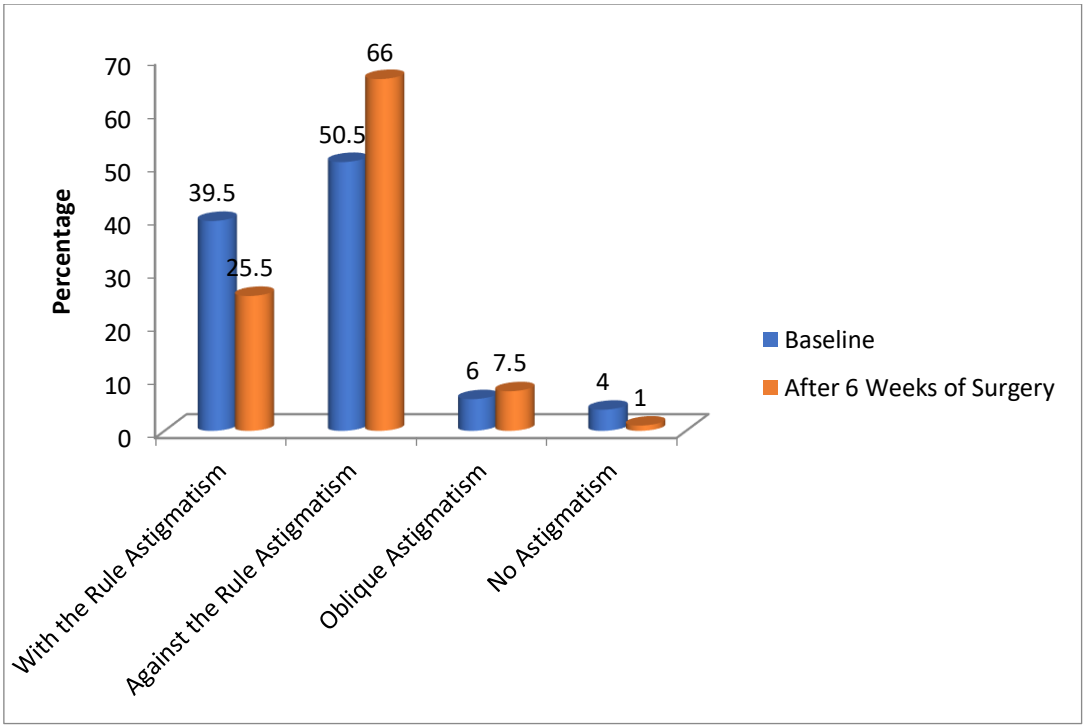

Figure 6: Type of astigmatism at baseline after 6weeks of surgery

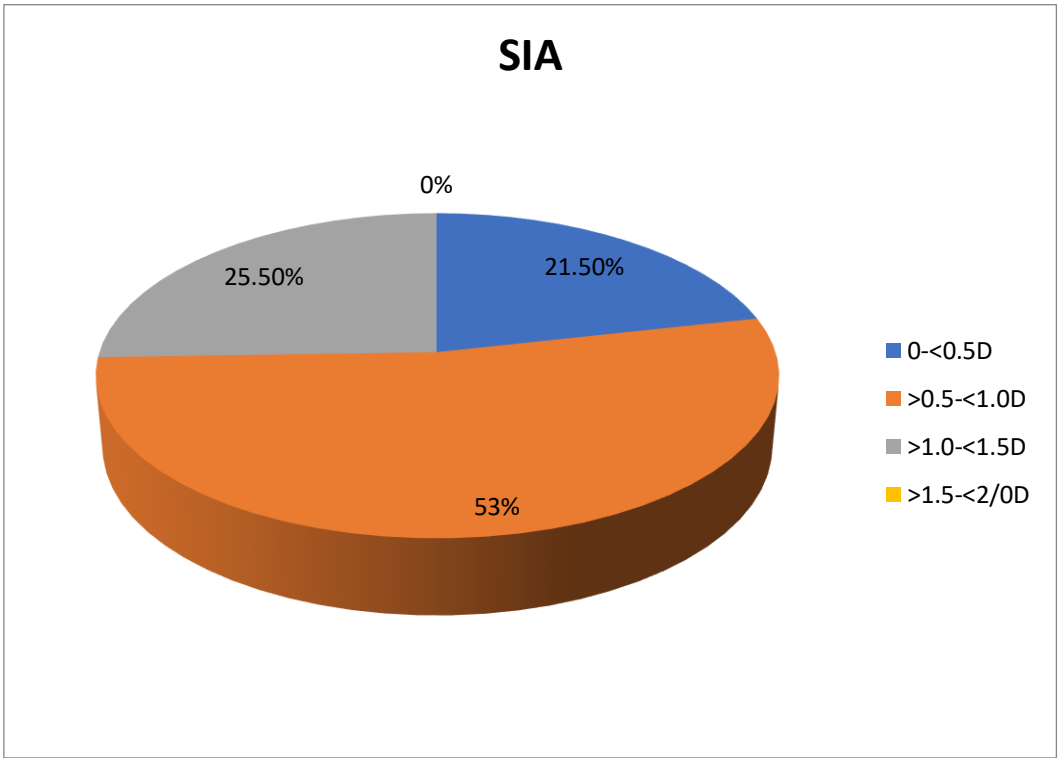

Figure 7: Surgical induced astigmatism (SIA) at 6 weeks

DISCUSSION

Cataract is one of the leading causes of blindness in India and the world.

Of the 200 subjects included in the study, **maximum subjects were in age range 61-70 years (51%),** followed by 44(22%) subjects>70 years of age, 31 (15.5%) subjects were 51-60 years of age and 23(11.5%) subjects were between 40-50 years of age. The minimum age of the included subjects was 46 years and maximum age was 83 years.

In present study **maximum involved subjects were female (n=111, 55.5%)** and rest of the subjects were males (n=89, 44.5%).

Cataract surgeries are the one and only available solution to this issue, and SICS performed in this study has shown favorable visual outcome, i.e.,

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among 200 operated eyes, the visual acuity showed that 92% patients had vision better than 6/18, followed by 1% patients who had moderate vision loss and 1% had severe vision loss. 87% in a study by Khandekar et al [7] and 99% by Venkatesh et al [8] showed similar results.

The study conducted by Dervenis N et al [3] showed 99.6% had vision better than 6/18 after phacoemulsification. Our study with SICS showed nearly equivalent outcome to this study.

According to the WHO and the International Agency for the Prevention of Blindness (IAPB) action plan, >85% should have a good vision of 6/12 - 6/18 post-cataract surgery [9]. Our study has exceeded this target at a 6-week follow-up period.

In SICS a variable amount of against the rule astigmatism is produced during wound healing owing to the cornea's flattening in the vertical meridian. The distribution of postoperative astigmatism was higher incidence of against rule astigmatism 66%, with rule astigmatism 25.5%, oblique astigmatism 7.5% and no astigmatism 1%. There was a statistically significant difference present between baseline and 6 weeks after operative procedure. (p=0.032). It concluded that significantly against the rule shift in astigmatism was seen after SICS. Generally, the corneal astigmatism seen is with-the-rule in young patients and there is a shift towards against the rule astigmatism as age advances. With the rule, astigmatism in younger age can be due to the upper and lower lids compressing a portion of the cornea and causing steepening of the vertical curvature. However, as age advances - the compressive effect of the lids is lessened by lid laxity, decreased tone of Muller's muscle and increased corneal rigidity. [14]

In study done by Manika M et al., (2021) [15] they found that in temporal phacoemulsification group, 50% patients had ATR astigmatism, 33.3% patients had WTR astigmatism, and 16.8% patients had no astigmatism. In superior SICS group, 53.3% patients had ATR astigmatism, 33.3% patients had WTR astigmatism, and 13.3% patients had no astigmatism.

In study done by Dole K et al., (2022) [16] in the manual SICS group, the vertical component of astigmatism was significantly lower postoperatively than preoperatively ($P < 0.001$), and the horizontal component of astigmatism was significantly more postoperatively than preoperatively ($P < 0.001$).

In study done by Alnuwaini M et al., (2020) [17] the distribution of postoperative astigmatism in Phaco was higher incidence of against rule astigmatism 62.1%, with rule astigmatism 20.4%, oblique astigmatism 15.5% and no astigmatism 1.9% among of that 103 patients with shifted toward against rule astigmatism. The distribution of postoperative astigmatism in the group MSICS was higher incidence of against rule astigmatism 63.1%, with rule astigmatism 19.4%, oblique astigmatism15.5% and no astigmatism 1.9% among of that 103patients with shifted toward against rule astigmatism.

In present study, the mean Surgical induced astigmatism at 6 weeks post operatively was 1.28±0.7. In a study done by Neameh GT et al., 2020[18] showed SIA of 1.3±0.9 in patients undergoing phacoemulsification. We had achieved Phacoemulsification - comparable SIA in our study.

In Manika M et al., (2021)[15] study, sutureless manual SICS (0.82 ± 0.72 D)induced slightly less astigmatism than phacoemulsification (0.966 ± 0.63 D), but the difference was statistically nonsignificant.

CONCLUSION

This study proves that a good visual outcome (as described by WHO 6/6- 6/18) can be achieved after SICS with posterior chamber intraocular lens implantation with low complication rate. Hence SICS can be performed safely and confidently to achieve visual rehabilitation, especially in areas with limited facilities and when subject belong to low socioeconomic group. As an alternative to phacoemulsification, SICS has gained popularity because of its comparable surgical and postoperative outcomes similar to phacoemulsification. Furthermore, SICS has added benefit of being a cheap and affordable technique; hence, it can be used in overcrowded poor communities. Due to the huge backlog of cataract patients in India, there is a requirement for surgeries which are affordable to both patients and surgeons. As minimum equipment in this surgery can give results equivalent to phacoemulsification, it should be preferred at centres with limited resources.

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