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Comparative Study Of Surgically Induced Astigmatism In Clear -Corneal And Sclero-Corneal Incision In Phacoemulsification

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Abstract-

Background- The objective of the study was to compare the surgically induced astigmatism post operatively in sclero-corneal and clear corneal incision in phacoemulsification.

Materials And Methods- The present study was carried out at tertiary care hospital from January 2020 to June 2021 to evaluate the surgically induced astigmatism after phacoemulsification in sclero corneal incision and clear corneal incision. A total of 172 patients with senile cataract having corneal astigmatism ≤ 1 D were included in the study.

Results- The mean surgically induced astigmatism in clear-corneal incision was 0.6025±0.4243, 0.4568±0.2533, 0.3620 ±0.2140 at POD1, POD 7, POD 30 respectively. In sclero-corneal incision, the mean SIA was 0.6095 ± 0.4197, 0.5589 ±0.3732, 0.4568±0.3936 respectively on POD1, POD 7 and POD 30. The mean SIA between Group A and Group B on POD 7 was found to be statistically significant (p=0.03) while that on POD 1 and POD 30 was not significant.

Conclusion- Our study showed no significant statistical difference in the SIA in both the groups on post-operative day 30 follow up.

Keywords- surgically induced astigmatism, clear-corneal incision, sclero-corneal incision.

Introduction:

Cataract, which is consistently the leading cause of blindness throughout the globe; is defined as "Opacity in the lens capsule or its substance". WHO reports that around 43% of blindness in the population is due to age related cataract. [(1)] The incidence of cataract is around 3.8 million every year in India and this number is expected to reach to 40 million by 2025 [(2).] Cataract is responsible for 62.6% cause of blindness in India out of the other causes of blindness. [(2)] . Cataract surgeries forms the basis of ophthalmology practice and remains the sole solution for providing satisfactory results for patients as well as the surgeon.

The basic aim of cataract surgery is to provide early and optimum visual rehabilitation. The degree of postoperative vision is attributed to accurate pre-operative biometric calculations and post-operative surgically induced astigmatism. If the extent of postsurgical astigmatism is controlled well in the surgery, then there is faster wound stability which further reduce the time required for visual rehabilitation. Corneal astigmatism which is basically a refractive error is very common after cataract surgeries. Post cataract corneal astigmatism affect

visual rehabilitation, limiting visual outcome and effectiveness of surgical procedure. Occurrence of astigmatism to a large extent depends upon the type, length, and position of incision and also the method of wound closure. [3]

The incision is the first and the most important determinant of postoperative astigmatism, which can be modified in various ways in terms of size, shape, location etc. to reduce the degree of postoperative astigmatism. There are two commonly used incision techniques in phacoemulsification-clear corneal incision and scleral tunnel incision. Sclero-corneal or limbal incisions are made between the mid limbal line and posterior limbal border. This is mainly to enhance wound healing and to exert less traction on cornea, hence controlling surgically induced astigmatism. Clear corneal incision is made in front of anterior limbal border. It has advantages of shorter tunnel length, an external direct entrance anterior to limbus, the abolition of need of cautery, choice of using topical anesthesia with no or minimal bleeding, less discomfort and faster recovery of wound.

Aim Of Study:

To compare the surgically induced astigmatism post operatively in sclero-corneal and clear corneal incision in phacoemulsification.

Materials And Methods:

The present study was carried out at tertiary care hospital from January 2020 to June 2021 to evaluate the surgically induced astigmatism after phacoemulsification in sclero corneal incision and clear corneal incision. A total of 172 patients with senile cataract having corneal astigmatism ≤ 1 D were included in the study. Patient with previous refractive ocular surgery, ocular surface disorder, collagen vascular disorder, keratoconus, patients having - brunescent cataract, grade IV /harder cataract, zonular weakness, complicated cataract, chronic uveitis, traumatic cataract, pseudo exfoliation, shallow anterior chamber, curvature myopia, hazy cornea, corneal opacities were excluded from the study. The study was approved from the local Institutional Review Board/ Ethical committee and follows the declaration of Helsinki.

All the cases were admitted one day before the surgery. Detailed history regarding ocular symptoms and systemic complaints were taken. Drug history and history of previous ocular surgeries and other relevant aspect were taken. General systemic examination was done to rule out systemic illness and relevant investigations carried out to rule out the same

In ocular examination, visual acuity (unaided and best corrected visual acuity) was recorded, and preoperative refraction was done. Anterior segment evaluation was done with slit lamp biomicroscope, and the cataract was graded by using "Lens Opacity Classification System". Posterior segment was evaluated using both direct and indirect ophthalmoscopy. Intra ocular pressure was recorded using applanation tonometer, lacrimal syringing was done in all cases. Keratometry readings were recorded using Grand Seiko Auto Ref/keratometer and Ascan immersion biometry (using Keeler Acutome) was done in all cases with SRK-T formula and IOL power was determined.

The patients who were admitted for cataract surgery and willing to follow study protocol were numbered sequentially and divided randomly into even and odd groups.

Group A (even group)- Underwent phacoemulsification by clear corneal incision

Group B (odd group)- Underwent phacoemulsification by Sclero-corneal incision.

Post operative Ocular examination of all patients was done and complications if any; were managed accordingly. Following evaluation was done on POD 1, POD 7 and POD 30- Visual acuity, Anterior segment examination, Fundus examination and Keratometry readings.

Pre and post operative visual acuity, keratometric readings and SIA was collected, and the data was entered using Microsoft Excel 2019.

Pre-operative and post-operative surgically induced astigmatism was calculated using Dr Warren Hill SIA calculator using vector analysis.

Results:

A comparative study of post-operative surgically induced astigmatism between clear-corneal and sclero-corneal incision in phacoemulsification was done at tertiary care hospital from January 2020 to June 2021. 172 eyes were included in study of which 86 underwent phacoemulsification by clear-corneal

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incision and 86 underwent phacoemulsification by sclero-corneal incision. Data entry was done using Microsoft Excel 2019. Analysis was done by SPSS version 17. To find the difference between post-operative SIA on day-1, day 7 and day-30 in sclero-corneal and clear-corneal phacoemulsification and the student T-test was used.

Maximum number of patients belonged to age group 50-59 years followed by age group of 60-69 years and mean age being 58.97 years (figure no 1).

Out of 172 patients, 79 were males (46%) and 93 were females (54%). There was no significant predisposition between males and females (figure no 2).

Majority of patients had pre-operative visual acuity between 6/36-6/18 (figure no 3)

Majority of patients had pre-operative visual acuity between 6/36-6/18.

The UCVA in maximum patients in both the groups on POD 1 (figure no 4) was in range of 6/24- 6/12 followed by 6/9- 6/6. While on POD 7 (figure no 5), maximum number of patients had visual improvement up to 6/9- 6/6 in both the groups. Similarly, on POD 30 (figure no 6) in both the groups, maximum patients had visual improvement to 6/9 – 6/6.

The pre-operative astigmatism between the groups was compared. Maximum patients in group A had astigmatism of 0.75 D (29.06%) followed by astigmatism of 1.00 D (23.25%). While in group B, maximum patients had astigmatism of 0.50 D (42.16%) followed by astigmatism of 1.00 D (23.25%). Patients with astigmatism of more than 1 D were excluded from the study. (Figure no 7)

On comparing the mean of astigmatism on post-operative day 1, 7 and 30, no significance between clear-corneal and sclero-corneal group was found. (Table no 1 and 2)

The post-operative SIA between group A and Group B on POD1, POD 7 and POD 30 was calculated and had the following values. (Figure no 8 and 9).

The mean SIA between Group A and Group B on POD 7 was found to be statistically significant (p=0.03) while that on POD 1 and POD 30 was not significant (table no 3)

Discussion:

The most common problem faced by surgeons following cataract surgery is SIA. A significant astigmatism can be visually disabling as it can cause blurring of vision, monocular diplopia, asthenopia and distortion of image. SIA is a complex problem because the final refractive result is influenced by various factors, such as incision size, incision site, incision type, pre-operative astigmatism, and the amount of manipulation during surgery. [73] In our study the incision size (2.8mm) and incision site (supero-temporal axis) was kept constant.

In our study, the two groups had mean age of 58.97 years. The mean age of group A was 57.25 years and group B was 60.68 years. Our study had 79 males (46%) and 93 females (54%) out of the total 172 cases which showed no statistical gender preponderance between both the groups.

The UCVA in Group A on POD 1 was between 6/24-6/12 in 56 (65.11%) patients and 6/9-6/6 in 30 (34.88%) patients. While in Group B, the UCVA on POD 1 was in range of 6/24-6/12 in 40 patients (46.51%) and in range of 6/9-6/6 in 46 (53.48%). After noting the UCVA on follow-up day 30, 67 patients (77.90%) in group A and 71 patients (82.55%) in Group B had UCVA in range of 6/9 - 6/6. No significant difference in the UCVA between the two groups on POD 30 was found. A similar observation was also found in a study by Tanushree V et al. [74] who showed that on 1-month post-operative 85% patients with clear-corneal phacoemulsification and 82.5% patients with sclero-corneal phacoemulsification had visual acuity in the range of 6/6-6/9. In a study done by Oshima Y, Tsujikawd K, Oh A, Harino S, 80% of the eyes in each group (clear corneal incision and scleral tunnel incision) achieved an UCVA of 20/40 or better from the second day postoperatively but no statistically significant difference in visual rehabilitation was seen which was similarly noted in our study. [49]. It was noted in our study that the SIA values on any follow-up was found to be lesser in clear-corneal incision group than the sclero-corneal incision group. Also, in a study by Tanushree et al, they found 33(82.5%) out of 40 patients with clear corneal incision had minimal postoperative astigmatism (0.25-0.50D) compared to 34(85%) out of 40 patients in scleral tunnel incision post-operatively concluding

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that clear corneal incision induces faster vision recovery with no significant difference found in post-operative astigmatism in between the two groups. (74)

The difference in stabilization of SIA from POD 1 to POD 30 was found minimal in both the groups. Thus, for a fixed site of incision, the SIA in our study was similar in both the groups. Our study however did not consider comparison of SIA between different sites of incision which was considered in a study by Latha NV et al, who showed that temporal corneo-scleral incision was found to have the lowest value of 0.52 D with a standard deviation of 0.29 D compared to temporal clear-corneal, Superior corneo-scleral incision and superior clear corneal incision. (76)

The mean SIA between the two groups was compared in our study. The mean SIA in clear-corneal group was 0.6025±0.4243 on post-operative 1st day, 0.4568±0.2533 on post-operative 1st week and 0.3620±0.2140 on post-operative day 30. The mean astigmatism in sclero-corneal group was 0.6095±0.4197 on post-operative 1st day, 0.5589±0.3732 on post-operative 1st week and 0.3936±0.4568 on post-operative day 30. Though there is lesser SIA found is clear-corneal (group A), the difference of mean SIA on POD 30 between group A and Group B was statistically insignificant.

A similar study by He Y et al. (51) showed change of corneal astigmatic diopter in Groups A (temporal clear corneal group) and B (superior scleral tunnel incision group) after 3 months postop from keratometric reading as 1.04 + 0.76 and 0.94 + 0.27, respectively (P = .84 >.05), showing no statistical significance difference. A follow up after 3-month post-operative period is however lacking in our study.

The corneal incision with mean astigmatism of 0.97D and scleral incision group with average mean of 0.91D A reported in a study conducted by Joshi MR and Shakya S also showed no statistical significance between two groups.(77) Also, in study by D. Satyavardhan Rao, the mean induced astigmatism in scleral incision was 0.55±0.28 and in clear corneal incision was 0.69±0.29. (75)

Lesser is the corneal astigmatism induced when the site of cataract incision is farther away from visual axis. In sclero-corneal incision, the visual axis is away from the site of incision and hence induces less SIA. But the wound healing and early wound stabilization is seen in clear-corneal incision than the sclero-corneal incision.

Our study lacked in comparing the patient's point of view regarding visual rehabilitation and post-operative discomfort following phacoemulsification.

In our study, attempt has been made to analyze only one variable i.e., incision type and the other variables have been kept constant. Attempt has been made to explain SIA following clear-corneal and sclero-corneal phacoemulsification.

Our study has reported clear-corneal technique to have slightly better outcomes as compared to sclero-corneal technique, but the difference is statistically insignificant. Hence, more studies involving larger sample size, with modification in site of incision according to pre-existing astigmatism and evaluation of post-operative complications are needed to evaluate the efficacy of both the techniques for reducing SIA.

Conclusion:

Our study showed no significant statistical difference in the SIA in both the groups on post-operative day 30 follow up. Thus, for same size and site of incision, both the approaches made in our study can be suitable in performing the phacoemulsification. The figures of mean SIA in our study were found to be less in clear-corneal than sclero-corneal incision from which we can say that clear-corneal incision induces less SIA. The present study also recommends a long-term comparative study with a larger number of subjects and a longer follow- up before labelling clear-corneal phacoemulsification cataract surgery as more effective for avoiding surgically induced astigmatism in the long run.

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Figures And Tables :

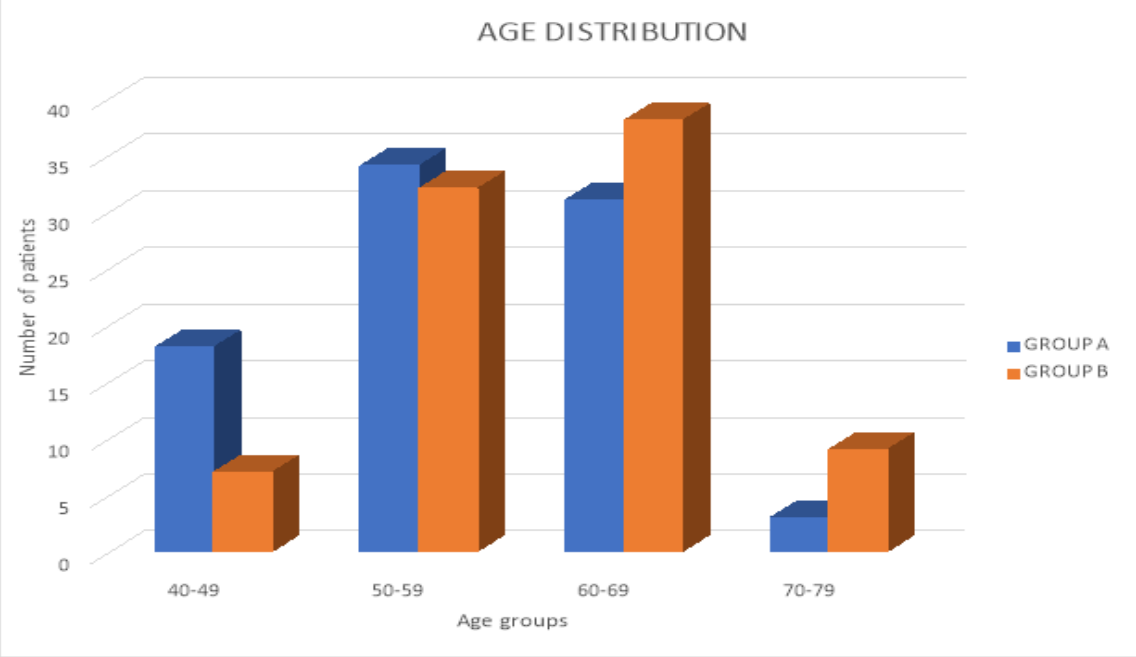

Figure no 1: Age Distribution

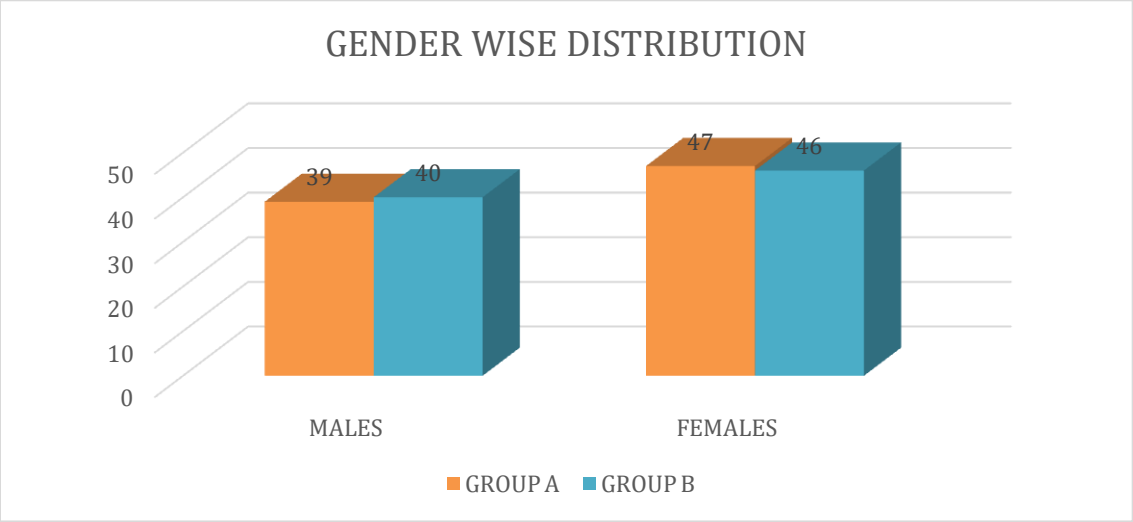

Figure no 2: gender wise distribution

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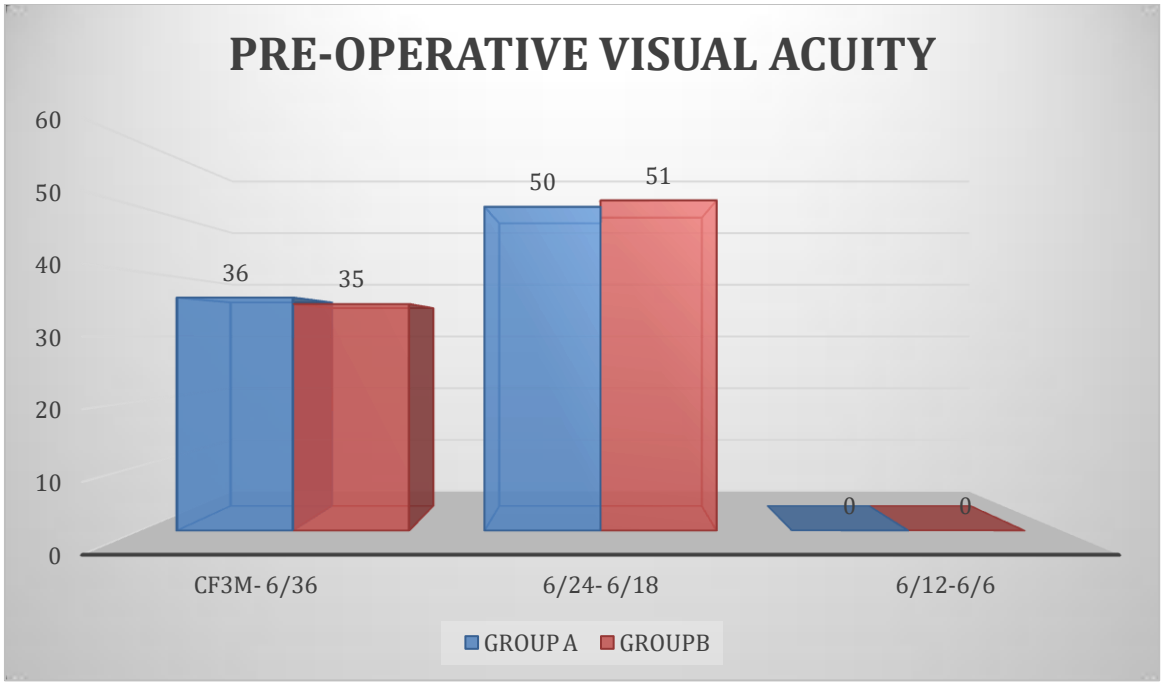

Figure no 3: pre-operative visual acuity Group A vs Group B.

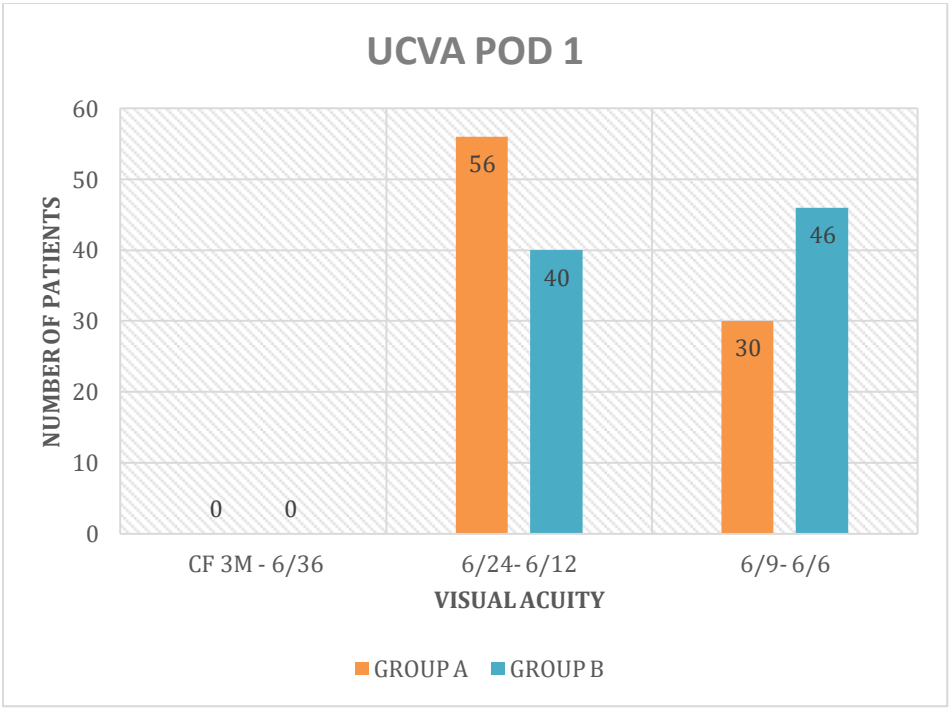

Figure no 4: Comparison of post-operative day1 UCVA in Group A vs Group B

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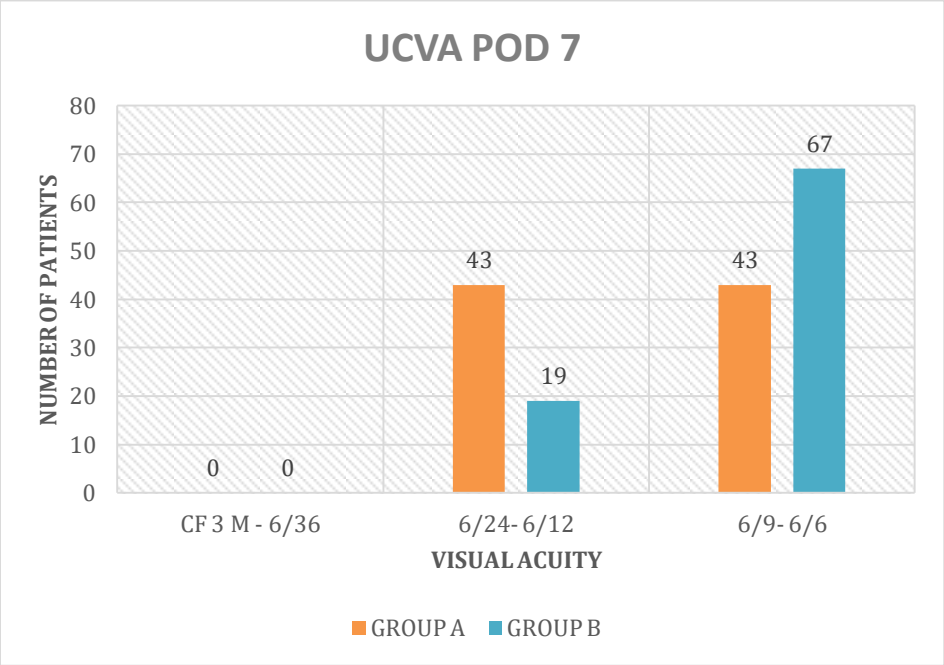

Figure no 5: Comparison of post-operative day 7 UCVA in Group A vs Group B

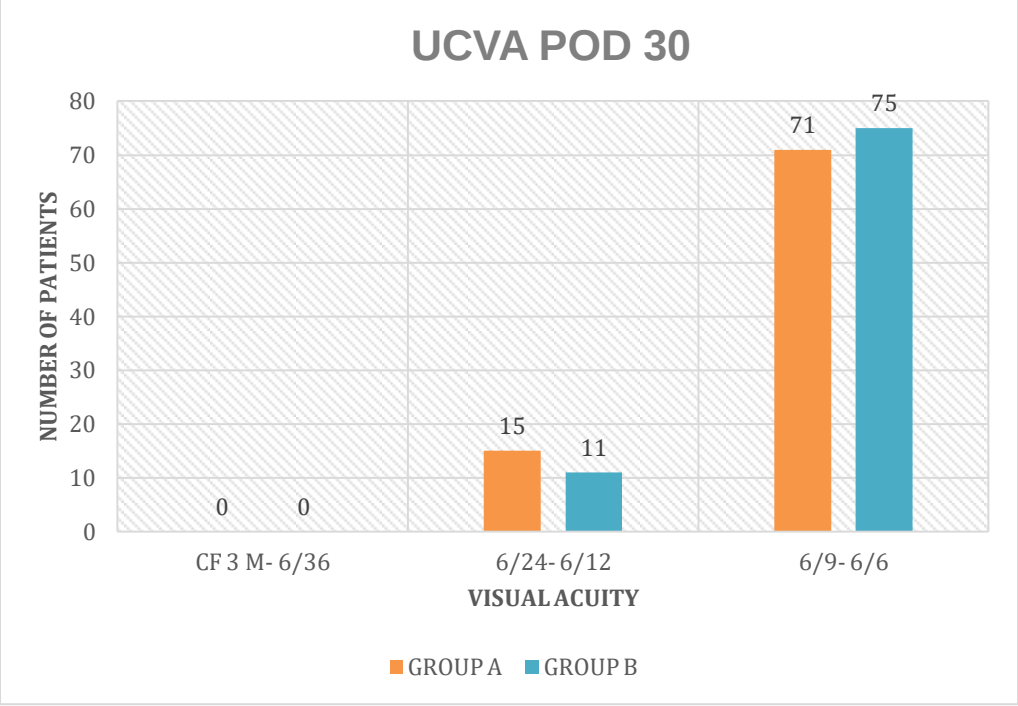

Figure no 6: Comparison of post-operative day 30 UCVA in Group A vs Group B

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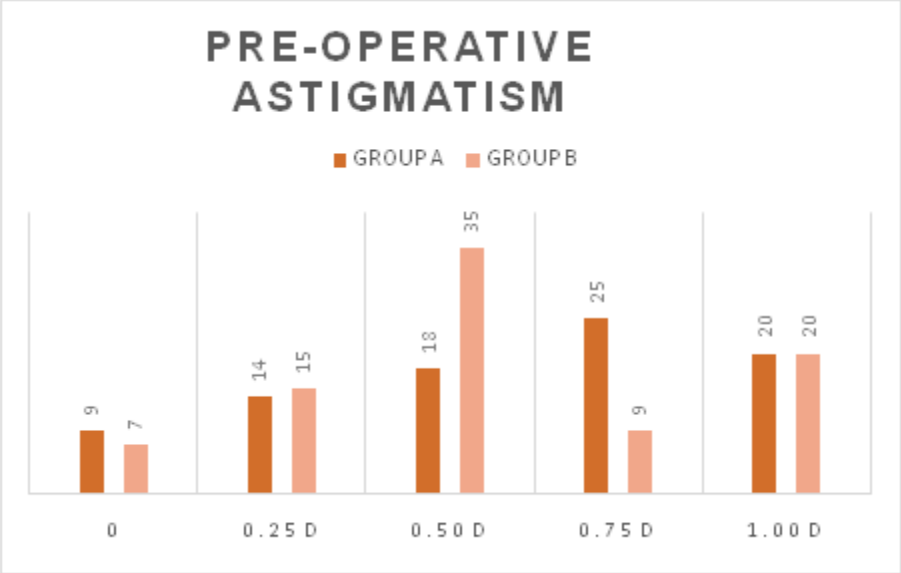

Figure no 7: Pre-operative astigmatism in Group A and Group B

TABLE NO 1- Post-operative astigmatism in Group A and Group B

GROUP A ASTIGMATISM	POD 1		POD 7		POD 30	
	GROUP A	GROUP B	GROUP A	GROUP B	GROUP A	GROUP B
0	15	17	22	19	25	21
0.25 D	31	22	32	33	23	31
0.50 D	20	21	9	19	16	18
0.75 D	8	10	21	7	6	16
1.00 D	8	8	2	0	16	0
1.25 D	4	8	0	8	0	0

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TABLE NO 2- Comparison of Post-operative Mean Group A and Group B

ASTIGMATISM	Group-A (Mean and Std. Dev.)	Group-B (Mean and Std. Dev.)	P value
Post op day1	0.5959±0.3235	0.5058 ± 0.4371	0.4311
Post op day 7	0.4215±0.3456	0.3837±0.3529	0.1606
Post op day 30	0.3982± 0.3625	0.3352± 0.2618	0.1846

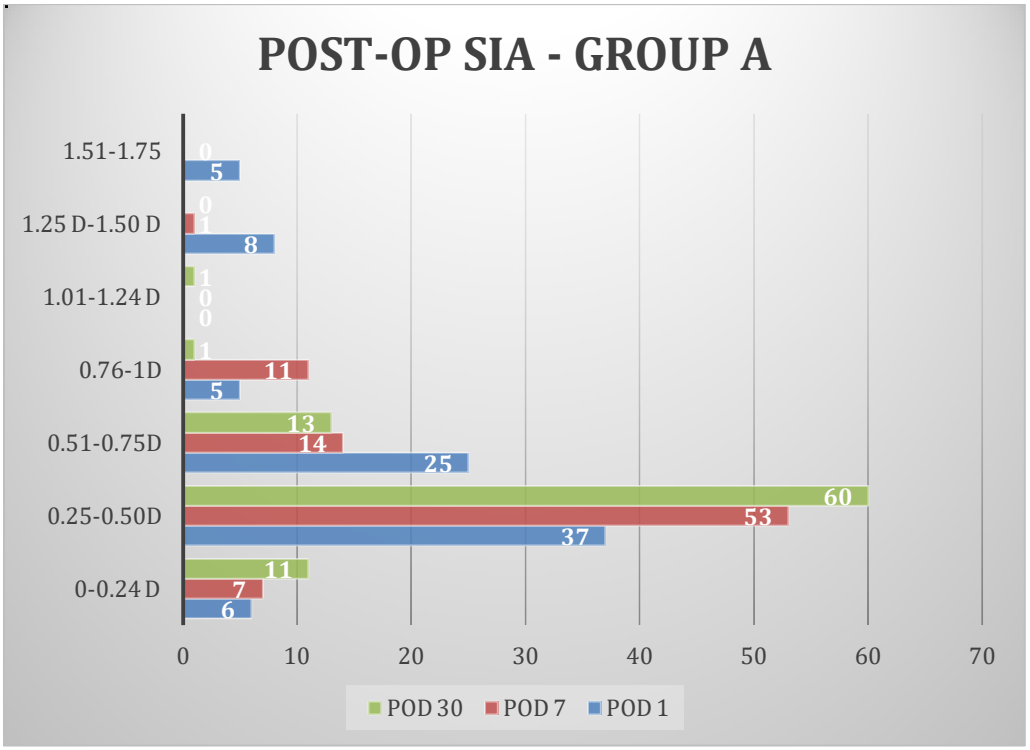

Figure no 8: Comparison of post-operative SIA Group A

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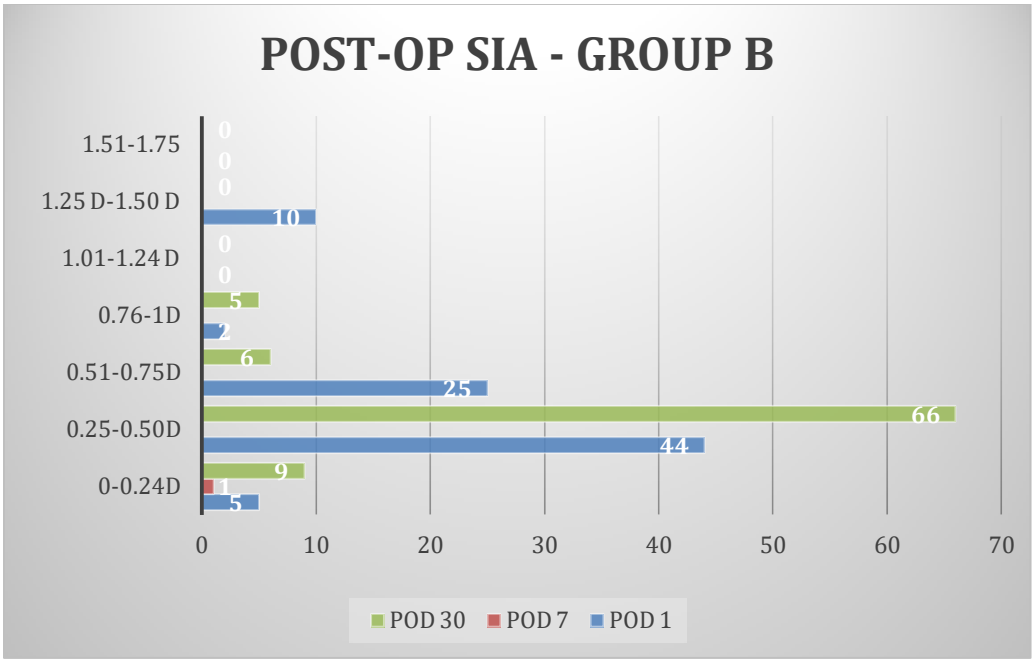

Figure no 9: Comparison of post-operative SIA Group B

Table no 3- comparison of post-operative mean SIA- group A vs Group B

Mean SIA	Group-A (Mean and Std. Dev.)	Group-B (Mean and Std. Dev.)	P value
Post op day1	0.6025±0.4243	0.5520 ± 0.3581	0.1
Post op day 7	0.4568±0.2533	0.5055 ±0.2950	0.02
Post op day 30	0.3620 ±0.2140	0.3816±0.2255	0.5595

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