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"Comparative Study of 2.8 mm Sclerocorneal Tunnel Incision Versus 2.8 mm Clear Corneal Incision In Phacoemulsification"

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ABSTRACT
Background: Phacoemulsification is accepted as gold standard surgical procedurefor the management of cataract in the modern era. There are two types of incision used in phacoemulsification – Sclerocorneal tunnel incision and Clear corneal incision. Recently preferences have been shifted from Sclerocorneal tunnel incision to Clear corneal incision in Phacoemulsification . Hence we are conducting this study to assess the merits and demerits of the two techniques.
Materials and methods:In this interventional and comparative study, a total of 100 patients were selected in the age group above 50 years for undergoing
Phacoemulsification. It was done fromNovember2018 – November 2020 at M.V.J. Medical College and Research Institute, Hoskote, Bangalore Rural.
The alternate eligible patients reporting to OPD were assigned in one of the two groups of 50 members each.
Group A- Patients with 2.8 mm Sclerocorneal tunnel incision
Group B – Patients with 2.8 mm Clear corneal incision
Patients were followed up after surgery on 1st post operative day,1 week, 1 month, 3 month and required follow up done during each visit and the outcome of the study was analyzed using, Mann Whitney u test and t-test.
Result: Inourstudywefoundthat98%ofthepatientswhounderwent Sclerocornealincision had6/12orbettervisionattheendofthreemonths.InClearcornealincision,98%of peoplehad6/12orbettervisionattheendofthreemonths.Thepostoperativevision between the two incision at the end of each post op visit was considered statistically insignificant by Mann Whitney utest.
Conclusion: There was no statistical difference in post operative astigmatism in between the two groupsinkeratometryatthreemonthpostoperativeperiodinourstudy.Sinceneither of the two groups was considered statistically significant,we can conclude that both the incision induced equal visualrehabilitation.
Keywords: Phacoemulsification, Clear corneal incision, Sclerocorneal incision, WTR, ATR, BCVA.

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I. Introduction

Cataract comes from a Latin word which means waterfall. It is the lossoftransparency of crystalline lens. World Health Organization (WHO)chartssenile cataractasaleadingcauseofblindness.Annualincidenceof3.8millioncataractand over9millioncataractblindpeoplehavebeenreportedinIndia[1]andexpectedtobe blind by 40 million in2025.[2]Cataract surgery is the removal of opacified crystalline lens and replacing it with artificial intraocular lens. It started at the time of Sushruta in the 800 BC[3] in form of practice of couching and evolved into Intracapsular cataract extraction (ICCE), Extracapsular cataract extraction(ECCE),Smallincisioncataractsurgery(SICS),Phacoemulsificationand Femtosecond laser surgery of recenttimes.Present day most popular surgery for cataract is Phacoemulsification, pioneered by Kelman in 1967[4.]

Phacoemulsification is one of the most important innovations in Ophthalmology. Now it is accepted as gold standard surgical procedure for the management of cataract. In Phacoemulsification the nucleus isultrasonically fragmented and aspirated by a small incision. It is opted asthe surgery of choice due to better patient compliance,earlier establishment of refraction, improved visual acuity and minimal post operative astigmatism and minimal complication.There are two types of incision used in phacoemulsification – Sclerocorneal tunnel incision andClear corneal incision. Recently preferences have been shifted from Sclerocorneal incision to Clear corneal incision in Phacoemulsification. Each of the two incision have their own advantages and disadvantages over each other. Hence we are conducting this study to assess the merits and demerits of the twotechniques.

II. Materials and Methods

Source of data : Patients undergoing Phacoemulsification procedure for cataract surgery in the Department of Ophthalmology at MVJ medical college and Research Institute, Bangalore.

Sampling procedure

The sample size is estimated based on one of the study where the prevalence is 62.8%. [5]Formula is: n= 4pq/L2 {p=prevalence, q=1-p and L=alloble error (20%). The sample size for this study was taken as 100 patients. The patients are selected in the age group above 50 years for undergoing
Phacoemulsification. The alternate eligible patients reporting to OPD were assigned in one of the two groups of 50 members each.

Group A- Patients with 2.8 mm Sclerocorneal tunnel incision

Group B – Patients with 2.8 mm Clear corneal incision

Study duration -From November 2018 – November 2020.

Sample size : Minimum of 100 patients.

Study design : It is an interventional and comparative study .

Study site – M.V.J. Medical College and Research Hospital

INCLUSION CRITERIA

- Patient undergoing Phacoemulsification for cataract at MVJ Medical College and Research Institute,who have given informedconsent.
- Male and Female patients above 50years.
- Grade1toGrade3nuclearsclerosis(LOCSIIIclassification).
- Having astigmatism < 1.25 D.

EXCLUSION CRITERIA :

- Non dilating miotic pupil.
- Brunescent cataract grade 4 and hardercataracts.
- Zonularweakness.
- Previous ocularsurgery.
- Coexisting ocular pathology.

Surgical Methodology

After taking written informed consent from the patient, they were divided into the above two groups. Visual acuity was taken with Snellens chart, refraction was done with Automated Refractometer, detailed anterior segment evaluation was done using Slit lamp biomicroscope and posterior segment evaluation was done with both Direct and Indirect Ophthalmoscope. IOL power was calculated using the SRK-2 formula. Pre-anesthetic evaluation was done and the patient was posted for surgery. Pre operatively TabletCiplox500mgBD starting from preoperative day till 5 days was given.Tab Pantaprazole 40 mg added to combactgastritis, Ciploxeyedrops4timeswasalsousedonthepre-operativedayasprophylactic antibiotic drops.

Under all aseptic precaution surgery was performed using Peribulbar Anesthesia with 2%Xylocaine,1500IUof hyaluronidase to increase the penetration of the Xylocaine and 0.5% Bupivacaine.

The Phacoemulsification procedure is done through the following incisions: -

Sclerocorneal tunnel route – A 2.8 mm triplanar incision was made about 2mm posterior to the Limbus and a Sclerocorneal tunnel with depth about 1/3rd of scleral thickness is dissected, extended into Clear cornea for 1 mm.

Clear corneal route – A 2.8 mm triplanar incision was made just anterior to the anatomical superior Limbus extending 1- 1.5 mm into the Cornea.

Following the surgery Gatiquin - P eye drops was prescribed to all patients every hour on the post op dayfollowedbytaperingofdosesto8-6-4-2-0weeklyforthenext4weeks.

Patients were followed up after surgery on 1st post operative day,1 week, 1 month, 3 month. Post op visual acuity was checked unaided and with pinhole at each visit with Snellens chart. Inevery visit detailedSlitlampexamination was done and Keratometry reading taken.The amountofastigmatism induced was measuredusingtheBauschandLombkeratometer. Any post operative complication was alsonoted. We used the Scalar analysis (direct subtraction of post operative cylinder from pre operative cylinder without taking the axis into consideration) for the estimation of post operative surgically induced astigmatism in our study.

Statistical Methods Used

Outcome of the study was analyzed using,

- Mann Whitney u test
- t-test

The level $P < 0.05$ was considered as the cutoff value or significant.

III. Results

TABLE1:POSTOPERATIVEUNCORRECTED VISUAL ACUITY IN SCLEROCORNEAL INCISION

SCLEROCORNEAL INCISION								
UCVA	DAY 1		WEEK 1		MONTH 1		MONTH 3	
	NO. OF PATIENTS	%	NO. OF PATIENTS	%	NO. OF PATIENTS	%	NO. OF PATIENTS	%
6/6	1	2	9	18	18	36	26	52
6/9	20	40	22	44	19	38	13	26
6/12	22	44	14	28	11	22	10	20
6/18	5	10	3	6	1	2	0	0
<6/18	2	4	2	4	1	2	1	2
TOTAL	50		50		50		50	

InourstudyvisualacuitywastakenusingSnellenschartafterthecataractsurgeryonpostoperative days. In Sclerocorneal incision it was seen that on day 1, 1 patients(2%)had6/6vision,20patient(40%)had6/9,22patients(44%)had6/12,5patients(10%) had 6/18, 2 patients (4%) <6/18 had vision. On week 1, 9patients(18%) had 6/6, 22 patients (44%) had 6/9,14 patients (28%) had 6/12, 3 patients (6%) had 6/18, 2 patients (4%) had < 6/18 vision. At 1 month follow up, it was seen that 18 patients (36%) had 6/6, 19 patients (38%) had 6/9, 11 patients (22%) had 6/12, 1 patients (2%) had6/18,1 patients (2%) had <6/18 vision.On the last follow up at 3 months it was seen that 26 patients (52%) had 6/6, 13 patients (26%) had 6/9, 10 patients (20%) had 6/12 and 1 patients (2%) had <6/18 vision.

GRAPH 1: POST OPERATIVE UNCORRECTED VISUAL ACUITY IN SCLEROCORNEAL TUNNEL INCISION

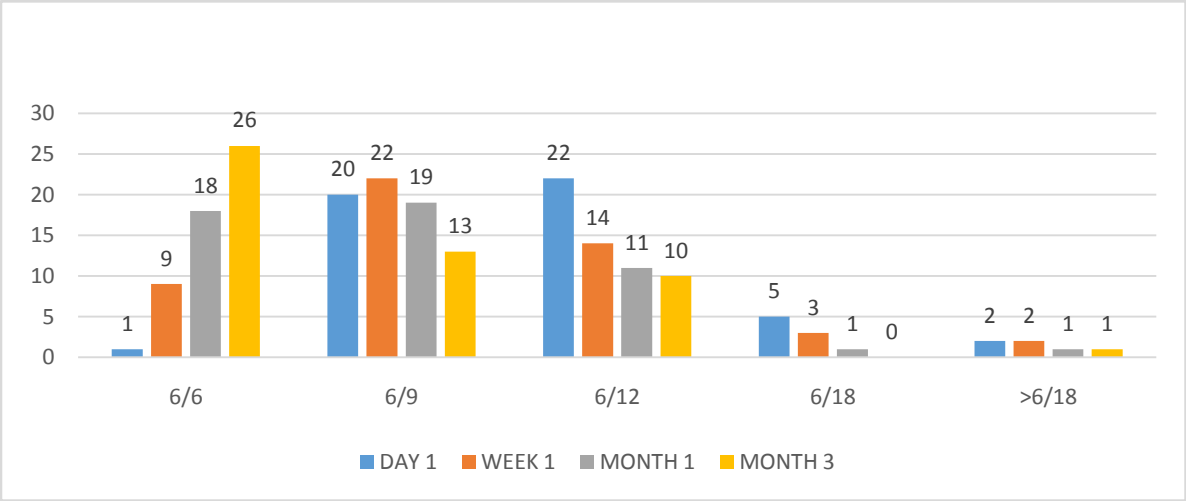


TABLE 2: POST OPERATIVE UNCORRECTED VISUAL ACUITY CLEAR CORNEAL INCISON

CLEAR CORNEAL INCISION								
UCVA	DAY 1		WEEK 1		MONTH 1		MONTH 3	
	NO. OF PATIENTS	%	NO. OF PATIENTS	%	NO. OF PATIENTS	%	NO. OF PATIENTS	%
6/6	5	10	12	24	17	34	18	36
6/9	25	50	30	60	25	50	25	50
6/12	16	32	4	8	4	8	6	12
6/18	2	4	4	8	3	6	0	0
<6/18	2	4	0	0	1	2	1	2
TOTAL	50		50		50		50	

InClearcornealincisiononday1thevisionacuitytakenwithsnellenschatshowed 5patients(10%)had6/6,25patients(50%)had6/9,16patients(32%)had6/12,2patients(4%)had6/18 visionand2patients(4%)had<6/18.Onweek1,12patients(24%)had6/6,30patients(60%)had6/9,4p atients(8%)had6/12,4patients(8%) had 6/18 and 0 patients had <6/18 vision. On month 1, 17 patients (34%) had 6/6 vision,25patients(50%)had6/9,4patients(8%)had6/12,3patients(6%)had6/18 and 1 patients (2%) had <6/18 vision. On the last follow up 18 patients (36%) had 6/6,25patients(50%)had6/9,6patients(12%)had6/12,0patients6/18visionand1 patients (2%) had<6/18 vision.

GRAPH2:POSTOPERATIVEUNCORRECTEDVISUALACUITYCLEAR CORNEALINCISION

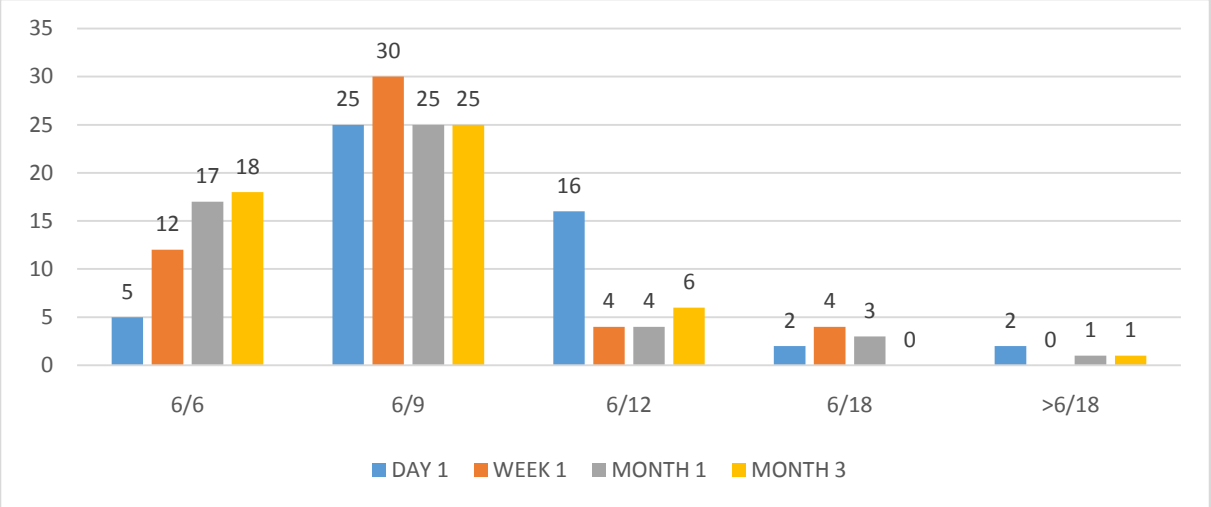


TABLE3:COMPARISIONOFTHEPOSTOPERATIVEUNCORRECTED VISUAL ACUITY BETWEEN THE TWOINCISON

POST OP VISUAL ACUITY				
	DAY 1	WEEK 1	MONTH 1	MONTH 3
p VALUE	0.61	0.75	0.76	0.45

Using theMann Whitney U test, the visual acuity between the two groups was compared at each time Interval and p value was calculated. On day 1 p value was

0.61,onweek1itis0.75,onmonth1itis0.76andmonth3pvalueis0.45.Sinceit is <0.05 it is considered statistically notsignificant.

TABLE 4: POST OPERATIVE AMOUNT OF ASTIGMATISM INSCLEROCORNEAL GROUP

GROUP A: SCLEROCORNEAL INCISION								
	DAY 1		WEEK 1		MONTH 1		MONTH 3	
	NO. OF PATIENTS	PERCENTAGE	NO. OF PATIENTS	PERCENTAGE	NO. OF PATIENTS	PERCENTAGE	NO. OF PATIENTS	PERCENTAGE
0.25	10	20	11	22	22	44	27	54
0.5	18	36	28	56	21	42	18	36
0.75	12	24	8	16	4	8	3	6
1	10	20	3	6	3	6	2	4
TOTAL	50		50		50		50	

PostoperativeastigmatismwasdocumentedinGroupA(Sclerocornealincision).On Day 1, 10 patients (20%) had 0.25 D of astigmatism, 18 patients (36%) had 0.5D, 12 patients(24%)had0.75D,and10patients(20%)had1.00D.Onweek1,11patients (22%) had 0.25 D of astigmatism, 28 patients (56%) had 0.5 D, 8patients(16%)had0.75D,and3patients(6%)had1.00D.Onmonth1,22patients(44%)had0.25Dofastigmatism,21patients(42%)had0.5D,4patients(8%)had0.75D, and 3 patients (6%) had 1.00 D. On the last follow up day at 3 months 27 patients (54%) had 0.25 D of astigmatism, 18 patients (36%) had 0.5 D, 3 patients (6%)had0.75 D, and 2 patients (4%) had 1.00 D.

GRAPH 3: POST OPERATIVE AMOUNT OF ASTIGMATISM IN SCLEROCORNEAL GROUP

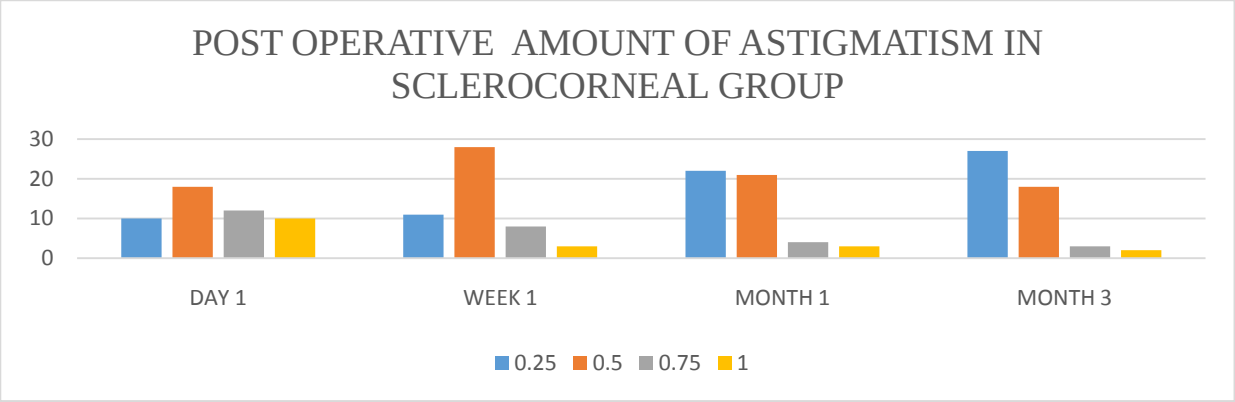


TABLE 5: TYPE OF POST OP ASTIGMATISM IN SCLEROCORNEAL INCISION

POST OP TYPE OF ASTIGMATISM							
DAY 1		WEEK 1		MONTH 1		MONTH 3	
WTR	ATR	WTR	ATR	WTR	ATR	WTR	ATR
23	27	18	32	18	32	20	30

Inthisgroupthepostoperativeastigmatismon Day 1 was 23 WTR and 27 ATR, on Week 1, 18 WTR and 32 ATR, on Month 1, 18 WTR and 32 ATR and on Month 3, 20 WTR and 30 ATR werepresent.

GRAPH 4: TYPE OF POST OP ASTIGMATISM IN SCLEROCORNEAL INCISION

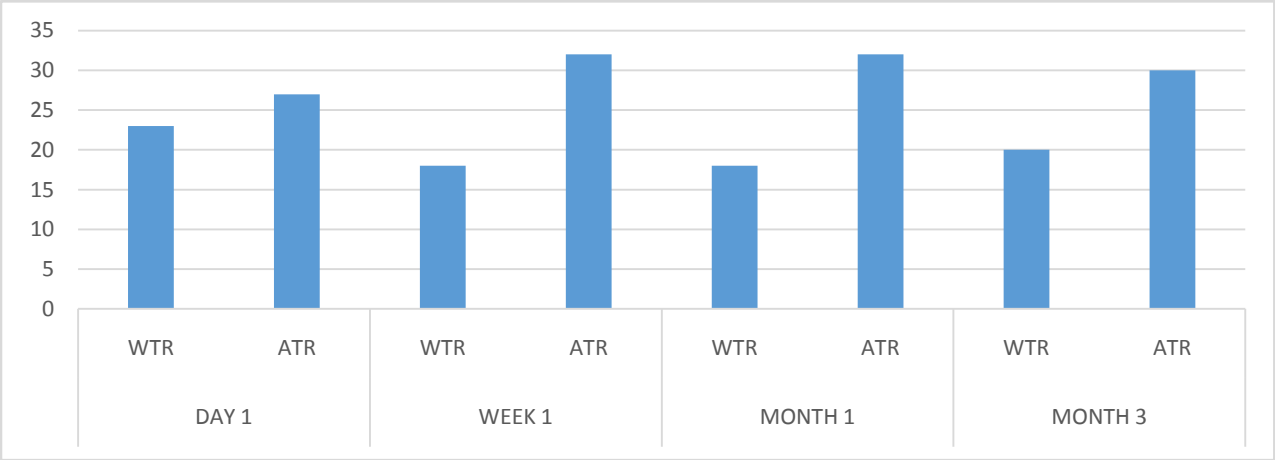


TABLE6 :POSTOPAMOUNTOFASTIGMATISMINCLEARCORNEAL INCISION

CLEAR CORNEAL INCISION								
DAY 1		WEEK 1			MONTH 1		MONTH 3	
DIOPTERS	NO. OF PATIENTS	PERCENTAGE	NO. OF PATIENTS	PERCENTAGE	NO. OF PATIENTS	PERCENTAGE	NO. OF PATIENTS	PERCENTAGE
0.25	13	26	14	28	21	42	22	44
0.5	17	34	26	52	20	40	20	40
0.75	13	26	6	12	4	8	3	6
1	7	14	4	8	5	10	5	10
TOTAL	50		50		50		50	

PostoperativeastigmatismwasdocumentedinGroupB(Clearcornealincision).On Day 1, 13 patients (26%) had 0.25 D of astigmatism, 17 patients (34%) had 0.5D, 13 patients(26%)had0.75D,and7patients(14%)had1.00D.OnWeek1,14patients (28%) had 0.25 D of astigmatism, 26 patients (52%) had 0.5 D, 6patients(12%)had0.75D,and4patients(8%)had1.00D.Onmonth1,21patients(42%)had0.25Dofastigmatism,20patients(40%)had0.5D,4patients(8%)had0.75D, and5patients(10%)had1.00D.Onthelastfollowupdayat3months22patients(44%) had 0.25 D of astigmatism, 20 patients (40%) had 0.5 D, 3 patients (6%)had0.75 D, and 5 patients (10%) had 1.00 D.

GRAPH 5 :POST OP AMOUNT ASTIGMATISM IN CLEAR CORNEAL INCISION

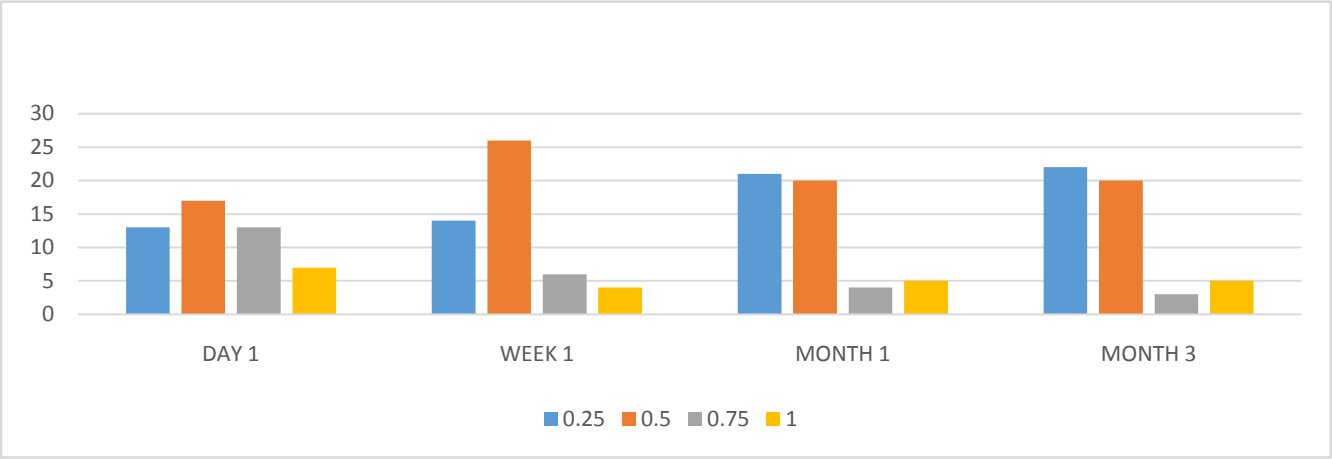


TABLE 7:TYPE OF POST OPERATIVE ASTIGMATISM IN CLEAR CORNEAL INCISION

POST OP TYPE OF ASTIGMATISM							
DAY 1		WEEK 1		MONTH 1		MONTH 3	
WTR	ATR	WTR	ATR	WTR	ATR	WTR	ATR
26	24	25	25	25	25	25	25

Inthisgroupthepostoperativeastigmatismon Day1was26WTRand24ATR,on Week1,25WTRand25ATR,onMonth1,25WTRand25ATRandonMonth3, 25 WTR and 25 ATR werepresent.

GRAPH 5:TYPE OF POST OPERATIVE ASTIGMATISM IN CLEAR CORNEAL INCISION

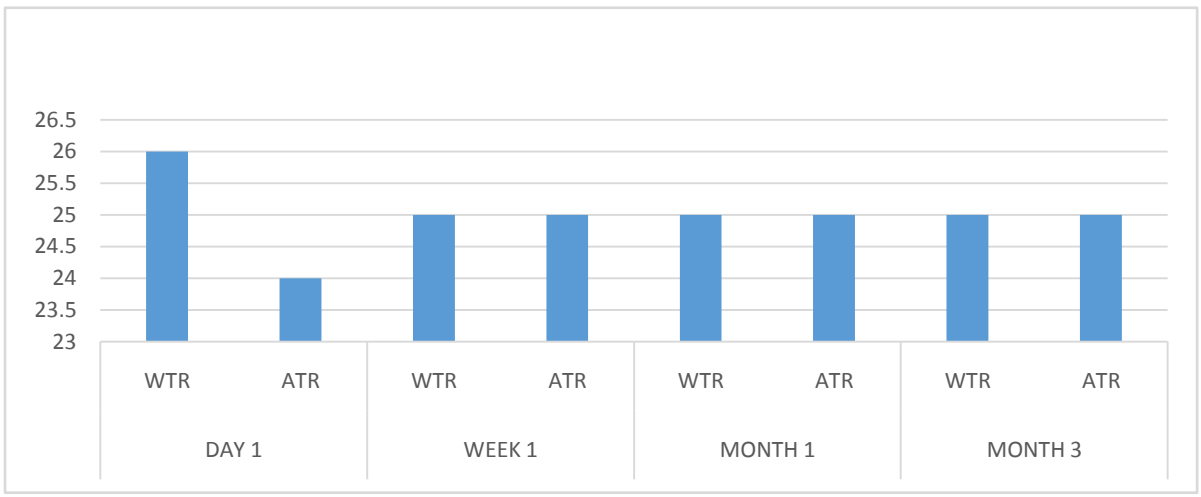


TABLE 7: COMPARISION OF TYPE OF POST OPERATIVE ASTIGMATISM BETWEEN THE TWO GROUPS

	GROUP A				GROUP B			
	WTR		ATR		WTR		ATR	
	MEAN	SD	MEAN	SD	MEAN	SD	MEAN	SD
DAY 1	0.55	0.27	0.65	0.24	0.58	0.28	0.53	0.19
WEEK 1	0.5	0.21	0.53	0.19	0.47	0.23	0.53	0.19
MONTH 1	0.44	0.21	0.43	0.21	0.43	0.27	0.51	0.18
MONTH 3	0.37	0.2	0.41	0.18	0.43	0.27	0.48	0.18

TABLE 8: CALCULATION OF p VALUE

	DAY 1		WEEK 1		MONTH 1		MONTH 3	
	WTR	ATR	WTR	ATR	WTR	ATR	WTR	ATR
p VALUE	0.68	0.11	0.66	0.9	0.84	0.24	0.44	0.22

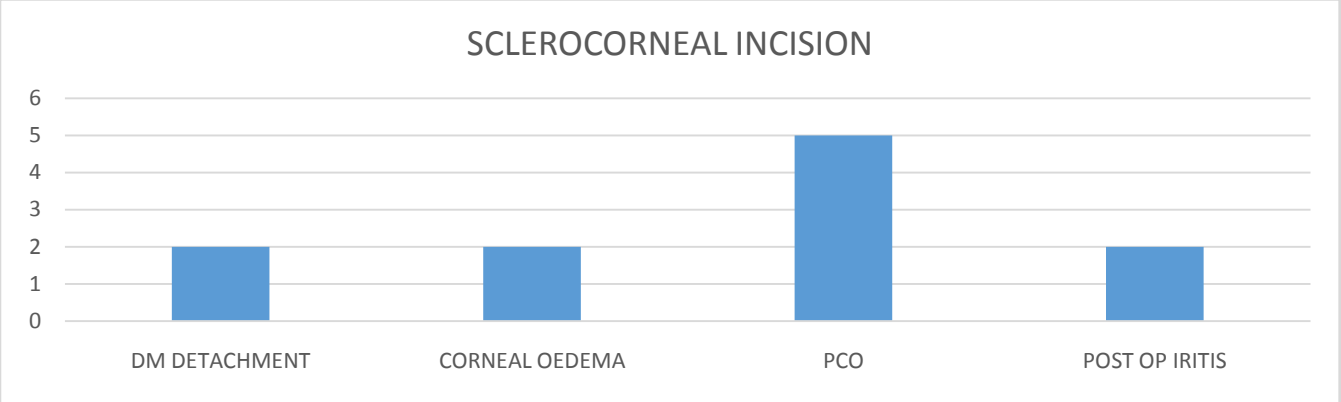
In our study after comparison of the type of and amount of astigmatism between the two groups, the p value was calculated using t-test. It was found that the p value at day 1 for WTR and ATR was 0.68 and 0.11 respectively, at week 1 p value for WTR and ATR was 0.66 and 0.90, at month 1, p value for WTR and ATR was 0.84 and 0.24 and at month 3, p value WTR is 0.44 and ATR is 0.22. Since the p value calculated was less than significant value <0.05, there is no statistical difference between the two group.

TABLE 9: COMPLICATIONS SEEN IN GROUP A AND GROUP B

COMPLICATIONS					
SCLEROCORNEAL INCISION			CLEAR CORNEAL INCISION		
	NO. OF PATIENTS	PERCENTAGE		NO. OF PATIENTS	PERCENTAGE
DM DETACHMENT	2	4	DM DETACHMENT	2	4
CORNEAL OEDEMA	2	4	CORNEAL OEDEMA	5	10
PCO	5	10	PCO	3	6
POST OP IRITIS	2	4	POST OP IRITIS	2	4
	11		TOTAL	12	

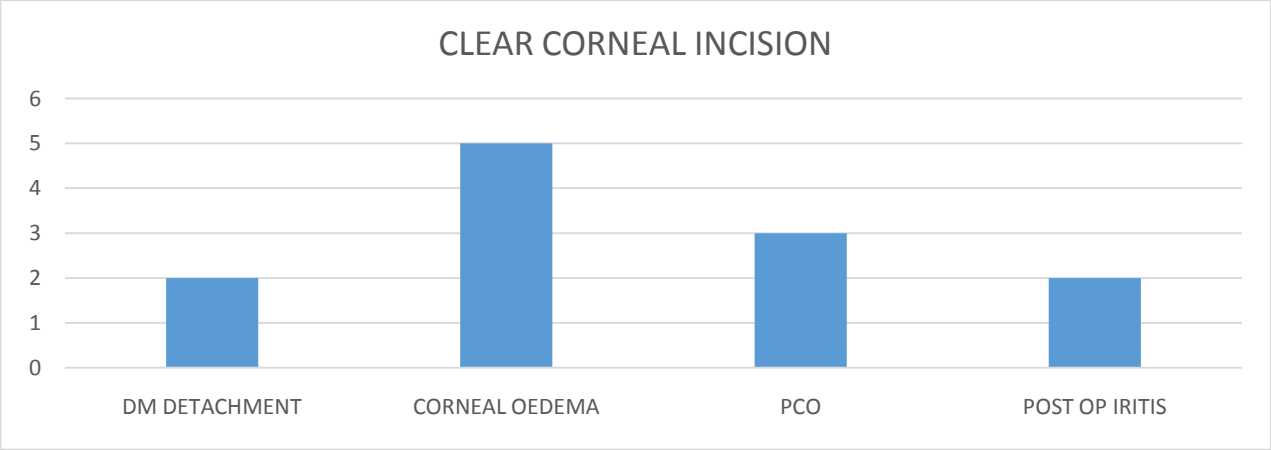
PCO- Posterior capsular opacification

GRAPH 6: COMPLICATIONS SEEN IN GROUP A SCLEROCORNEAL INCISION



In our study of complications of Phacoemulsification using Sclerocorneal incision noted a total of 11 complications including both intra operative and post operative. It was found that Group A had 2 Descemets membrane detachment (4%), 2 corneal oedema (4%), 5 posterior capsular opacification (10%), 2 post operative iritis (4%).

GRAPH 7: COMPLICATIONS SEEN IN GROUP B CLEAR CORNEAL INCISION



In Group B Clear corneal incision noted a total of 12 complications including both intra operative and post operative. It was found that Group B had 2 Descemets membrane detachment (4%), 5 corneal oedema (10%), 3 posterior capsular opacification (6%), 2 post operative iritis (4%)

IV. Discussion

This study was done to compare the effects of Sclerocorneal tunnel incision versus Clear corneal incision on basis of visual outcome , post operative astigmatism and to analyse any intra-operative or post operative complications between the two groups of phacoemulsification.

Post operative visual acuity using Snellens chart was taken on post operative day 1, week 1, month 1, month 3. Using theMann Whitney U test, the visual acuity between the two groups was compared at each time Interval and p value was calculated. On day 1 p value was 0.61, on week 1 it is 0.75, on month 1 it is 0.76 and month 3 p value is 0.46. Since it is <0.05 it is considered statistically not significant.

In a study conducted by Karpo KO, Albanis CV, Pearlman Jb, Goins KM with clear corneal and scleral tunnel incision showed best corrected visual acuity of 20/40 or better was achieved in 82.5% of all eyes with temporal clear corneal incision and in 75.3% of all eyes with superior scleral tunnel incision (p=<0.05). [6]The difference between the BCVA between the two groups was not statistically significant.

In a study done by Oshima Y, Tsujikawd K, Oh A,Harino S showed that eighty percent of the eyes in each group achieved an uncorrected visual acuity of 20/40 or better from the second day postoperatively. No statistical difference in visual rehabilitation or other parameters was noted between the two groups through out the study. [7]

Post operative keratometry readings using Bausch and Lomb Keratometry were taken on post operative day 1, week 1, month 1, month 3.On comparing the p value of WTR and ATR astigmatism between the two groups on different post op days, it was seen that p value was <0.5 was was considered insignificant.

A comparative study by Ernest P etal showed 2.2mm scleral corneal tunnel limbal incision causes significantly less surgically inducedastigmatism relative to a similar sized Clear corneal incision. [8]
Our study did not show any significant difference in the post operative astigmatism between the two groups.

A comparative study by Hayashi K et al showed no changes in corneal astigmatism in 2mm sized clear corneal and sclerocorneal tunnel incisions. Whereas 3mm clear corneal incision resulted in significantly greater astigmatism than the similar sized Sclerocorneal tunnel incision.[9]

Study by Reddy B et al on comparing post operative astigmatism by phacoemulsification with clear corneal and scleral corneal tunnel incision showed 1.08+/-0.36D and 1.23+/-0.71D of astigmatism respectively, which indicated more post operative astigmatism in Scleral corneal tunnel incision.[10]

In our study complications like DM detachment ,post operative iritis, corneal oedema were noticed in both the groups which resolved eventually. PCO was seen 8 cases which was later treated with Nd YAG capsulotomy.

In one study central and peripheral corneal thickness was measured in patients undergoing phacoemulsification with IOL implantation. Results were compared between sclerocorneal tunnel group and clear corneal group . It was noted that incidence of corneal oedema and other corneal complications in clear corneal group were more than in sclera tunnel group[11]

Hurvitz in his study found that a clear corneal cataract wound ruptured after trivial trauma. The wound did not meet the criteria for wound stability as previously recommended.[12]

In a case control conducted by Cooper BA et al to study the possible association of endophthalmitis, it was seen that clear corneal incision had statistically significant risk factor than sclerocorneal tunnel incision. There was no case of endophthalmitis in our study.[13]

V. Conclusion

In our study we found that 98% of the patients who underwent Sclerocorneal incision had 6/12 or better vision at the end of three months. In Clear corneal incision, 98%of people had 6/12 or better vision at the end of three months. The post operative vision between the two incision at the end of each post op visit was considered statistically insignificant by Mann Whitney u test.

The average astigmatism in sclerocorneal tunnel incision at the end of 3 months is 0.39D while in clear corneal is 0.45D. Since the p value is >0.05, it is considered statistically insignificant.
Complications like DM detachment, Post operative iritis, corneal oedema, PCO were noticed in both groups.
PCO was treated with Nd:YAG capsulotomy.
Since the outcome in neither of the two groups was considered statistically significant, we can conclude that both the incision induced equal visual rehabilitation.

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