IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 15, Issue 2 Ver. III (Feb. 2016), PP 36-44
www.iosrjournals.org

To Compare & Evaluate Surgically Induced Astigmatism Following Bimanual Phacoemulsification(BMP)(1.8mm), Conventional Coaxial Phacoemulsification(CCP)(3.2mm)& Manual SICS(M-SICS)(5.5mm Frown)

Dr. Jitendra Kumar[1], Dr. Shruti Vaish[2]
[1,2] *(Department of ophthalmology, M.L.B. Medical College, Jhansi, Uttar Pradesh, India)*

Abstract:
Objective:*To compare & evaluate surgically induced astigmatism following bimanual phacoemulsification(BMP)(1.8mm),Conventional coaxial phacoemulsification (CCP)(3.2mm) & manual SICS(M-SICS)(5.5mm frown)*
Patients & Methods*: Sixty patients were enrolled between June 2014 -June 2015,all with Senile cataract. Twenty patients were randomly assigned to the bimanual microincision phacoemulsification group,twenty patients to the coaxial phacoemulsification group & another twenty to manual SICS group. All patients were followed after 1 day, 1 Week, 1 month and 3 months of the procedure.*
Results*: The bimanual group demonstrated a reduced surgically induced astigmatism (SIA).The coaxial group demonstrated a slight rise in SIA & manual SICS group demonstrated a further slight rise in SIA. The SIA was 0.312 ± 0.137, 0.592±0.346, 2±0.513 resp.in bimanual phacoemulsification, coaxial phacoemulsification & manual SICS.There is a highly significant difference between postoperative SIA in between three groups during the postoperative period(P <0.001).*
Conclusions*: Microincisional cataract surgery using bimanual phacoemulsification has many advantages but it is limited by the lack of suitable intraocular lenses for implantation through microincisions; hence, switching to this technique from the conventional one still depends on the advancement in IOL Technology available & its cost effectiveness. So, that in future it can become gold standard technique.*
Keywords*: Bimanual microincision, coaxial phacoemulsification, cataract surgery, manual SICS, Surgically induced astigmatism.*

I. Introduction

Cataract surgery continues to evolve, embracing smaller incisions that allow quicker recovery, better wound strength, and increased surgical control, resulting in lower complication rates and better outcomes. Phacoemulsification was carried out through an ∼3-mm incision using an ultrasound (US) tip that is within a silicon sleeve, allowing irrigation, US delivery, and aspiration of lens matter through the same instrument [1]. Microincision phacoemulsification through a sub 2-mm incision was reported in the mid 1980s. However, it has only become popular in recent years, as technical improvements have allowed this to be performed with safety in addition to the availability of intraocular lenses (IOLs) that can be implanted through a sub 2-mm incision [2]. Microincision cataract surgery offers quicker visual recovery, reduced surgically induced astigmatism (SIA), and reduced complication rates with more secure wounds, and some unique advantages offered by bimanual microincision phacoemulsification make it the preferred technique for some surgeons [3]. Manual small incision cataract surgery (MSICS), similar to the extracapsular cataract extraction (ECCE) technique but with its sutureless relatively smaller incision, has similar advantages to phacoemulsification and is affordable. It has evolved as an effective alternative to phacoemulsification in the present times because it combines both sutureless advantages of phacoemulsification with minimum investment. Moreover, MSICS can be performed in almost all types of cataract in contrast to phacoemulsification where case selection is extremely important for an average surgeon; hence, it is a more appropriate surgical procedure for the treatment of advanced cataract in the developing world [4].

Objective of the study

To compare & evaluate surgically induced astigmatism following bimanual phacoemulsification(BMP)(1.8mm),Conventional coaxial phacoemulsification(CCP)(3.2mm) & manual SICS(M-SICS)(5.5mm frown).

II. Material And Methods

The Prospective type of study included 60 cases of age related cataract (Senile cataract) which were conducted in ophthalmology department of M.L.B. medical college, Jhansi from June 2014 -June 2015. Patients having good endothelial cell counts,well dilated pupils,intact zonular apparatus and good ocular tone and with no systemic or any other ocular disease were included & those having Fuch's dystrophy, Microphthalmos, Zonular dialysis,Lens subluxation,Congenital anamolies,recurrent episodes of anterior uveitis with synechiae formation,earlier filtering surgery or previous ocular surgery history in the same eye, Glaucoma, corneal dystrophy, scaring, any other corneal pathology, retinal diseases,relative anterior microophthamos, diabetes, hypertension, complicated cataract were excluded from the study. Enrolled patients were prospectively randomized before intervention into one of the three treatment groups. All participants signed an informed consent.Cataract was confirmed by clinical examination,slit-lamp examination &fundus examination. Patient's biometry was done.Visual acuity assessed-unaided, with pin hole & aided (with glasses) in each eye using snellen's chart preoperatively & then postoperatively at post-op day1^{st} ,7^{th},30^{th} ,90^{th}day. The patients were given 'peribulbar block'.

.

2.1. Conventional Coaxial Phacoemulsification Technique: A 3.2 mm partial thickness incision was given at the superior clear corneal area at 12o'clock.A side port was made at 10 o'clock with MVR knife. A cystitome-bent 26G needle was inserted through 10o'clock side port and a continuous curvilinear capsulorrhexis (4.5-5.5mm) was done under usage of HPMC 2%.Second side port was made at 2o'clock position with MVR knife.Hydrodissection followed by hydrodilineation done & bimanual nucleus rotation was performed with the dialer. Phacoemulsification machine used is of ZEISS visalis 100. An ozil torsional handpiece with a standard ultrasonic titanium 30 degree tip covered with standard microsmooth infusion sleeve having bubble suppression insert was used to emulsify cataracts using stop & chop technique.The phaco probe was placed through the 12o'clock incision.The groove was enlarged & the nucleus cracked, keeping the non-irrigating chopper & phaco tip at the base of the groove & pulling horizontally in the opposite direction. After emulsification of nuclear fragments, irrigation & aspiration of residual cortical matter was done. A foldable IOL was inserted through the preloaded injector(Acrysofa) into the capsular bag & dialed to proper position. HPMC 2% is aspirated coaxially from AC,from behind the iris & from behind the IOL. Subconjunctival injection of antibiotic and steroid given & eye is bandaged.

2.2. Bimanual Phacoemulsification Technique: A 1.8mm partial thickness incision was given at the superior corneal meridian at 12o'clock.A side port was made at 10 o'clock with MVR knife.AC formed with HPMC 2%.A cystitome-bent 26G needle was inserted through 10o'clock side port to make continuous curvilinear capsulorrhexis (4.5-5.5mm). Second side port was made at 2o'clock position with 0.9mm MVR Knife.Hydrodissection followed by hydrodilineation done & bimanual nucleus rotation was performed with the dialer.Phacoemulsification machine used is of ZEISS visalis 100. An ozil torsional handpiece with a 0.9 mm titanium 45degree sleeveless tip introduced into the AC from 12o'clock position & 20G irrigating chopper was introduced from 2o'clock side port. Stop & chop technique was used to emulsify cataract. After emulsification of nuclear fragments, irrigation & aspiration of residual cortical matter was done. A foldable IOL inserted through the preloaded injector(Acrysofa) into the capsular bag & the IOL is dialed. HPMC 2% is aspirated coaxially from AC,from behind the iris & the IOL. Subconjunctival injection of antibiotic and steroid given &eye is bandaged.

2.3. Manual SICS (Small Incision Cataract Surgery): In superior sclera incision type, incision of 5.5mm was fashioned 2mm behind the limbus in superior sclera area extending from 11 O'Clock to 1'O Clock meridians. A scleral tunnel was fashioned with a crescent blade. The incision extended approximately 1mm into the cornea & carried out towards the limbus on both sides to create a funnel shaped "pocket".Anterior capsulotomy done with a bent 26-gauge needle. Hydro dissection was done and the nucleus was delivered out.Cortical aspiration was done. Posterior chamber intra ocular lens (PCIOL) was inserted. The anterior chamber was then reformed with balanced salt solution. Subconjunctival injection of antibiotic and steroid given.

2.4. Post-Operative Parameters/Follow Up: Following postoperative parameters were evaluated on post-op day1, day7, 1 month, 3 months .

- **Visual acuity(VA):**Unaided
- **Best corrected visual acuity(BCVA):** With pin hole .
- Corneal astigmatism was measured.
- Corneal astigmatism was calculated by using simple substraction method. The difference in K reading values of vertical & horizontal meridias were calculated & compared with their preoperative values. The

mean K value readings were calculated separately for two meridian & compared within the group & between the groups preoperatively & postoperatively at different time intervals.SIA was calculated by substracting preoperative from postoperative astigmatism.

- Refraction

2.5. Statistical Analysis: Chi square test & Unpaired T–test were applied to find out the significant difference between these techniques & to analyze the results of study.

III. Figures And Tables

Between June 2014- June2015, 20 patients were operated using CCP, 20 patients were operated using BMP & 20 patients were operated using MSICS. The analysis was carried out on 60 patients consisting of 32female patients and 28 male patients ranging in age between 45and 65years.Baseline characteristics were similar in all groups.

TABLE I: DEMOGRAPHIC DETAILS AND OUTCOMES FOR STUDY EYES UNDERGOING BMP , CCP AND MSICS.

	CCP Mean± SD	**BMP Mean± SD**	**M -SICS Mean± SD**
SEX			
Male	14	6	8
Female	6	14	12
Age(years)	54.25	54.9	58.35
Preoperative data:			
VA			
>6/18	0	0	0
6/18-6/60	8	9	8
<6/60	12	11	12
BCVA:	1.511±0.687	1.454±0.729	1.818±0.954
Average Kv	44.61±2.004	44.66 ±2.509	44.43±2.004
Average Kh	45.15 ±2.09	44.71 ±1.98	45.01±2.573
Axial. Length	22.51±0.993	22.44±1.10	23.33± 1.87
Biometry	21.75±2.28	22.07±3.51	19.72± 5.03
Post-operative VA			
Day7			
>6/9	0	1	0
6/12-6/18	17	19	4
6/24-6/60	3	0	16
>6/60	0	0	0

TABLE II: DISTRIBUTION OF PREOPERATIVE CORNEAL ASTIGMATISM IN DIFFERENT STUDY GROUPS

Corneal astigmatism (D)	**Group 1 Conv. Phaco(n=20)**		**Group 2 Manual SICS(n=20)**		**Group 3 Bimanual Phaco(n=20)**		**Total**	
	No.	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
0	**1**	**5%**	**1**	**5%**	**1**	**5%**	**3**	**5%**
<1	**9**	**45%**	**19**	**95%**	**17**	**85%**	**45**	**75%**
>1	**10**	**50%**	**0**	**0**	**2**	**10%**	**12**	**20%**
Total	**20**		**20**		**20**		**60**	
x^2 =	**17.733**							
df=	**4**							
p-value	**0.001391(S)**							

TABLE III: MEAN PREOPERATIVE AND POSTOPERATIVE VISUAL ACUITY (BCVA) AT DIFFERENT TIME INTERVALS (LOG MAR VALUES)

BCVA	**Group 1 Conv. Phaco(n=20)**	**Group 2 Manual SICS(n=20)**	**Group 3 Bimanual Phaco(n=20)**	**P –value**		
Preop	1.511±0.687	1.818±0.954	1.454±0.729	Gp1&2 =0.1431 (NS)	Gp2&3=0.1832 (NS)	Gp1&3=0.8005 (NS)
Day 1	0.1935±0.15	0.259±0.126	0.2105±0.135	=0.1431 (NS)	=0.2475 (NS)	=0.7085 (NS)
Day 7	0.17±0.13	0.259±0.126	0.189±0.102	=0.0341 (S)	=0.0610 (NS)	=0.6101 (NS)
Day 30	0.17±0.13	0.252±0.127	0.189±0.102	=0.0507 (S)	=0.0918 (NS)	=0.6101 (NS)

Day 90	0.17±0.129	0.252±0.127	0.180±0.110	=0.0499 (S)	=0.0629 (NS)	= 0.7934 (NS)

TABLE IV: DISTRIBUTION OF UCVA AT DIFFERENT TIME INTERVALS

	Preoperative		**Day 1**		**Day 7**		**Day 30**		**Day 90**	
Group 1 (Conv. Phaco.) n=20	N	%	N	%	N	%	n	%	n	%
>6/9	0	0	0	0	0	0	4	20%	7	35%
6/12-6/18	0	0	11	55%	17	85%	15	75%	12	60%
6/24-6/60	8	40%	9	45%	3	15%	1	5%	1	5%
>6/60	12	60%	0	0	0	0	0	0	0	0
					x^2 =95.818					
					df=12					
					p-value =<0.001 (HS)					
Group 2 (manual SICS) n=20	N	%	N	%	N	%	n	%	n	%
>6/9	0	0	0	0	0	0	0	0	2	10%
6/12-6/18	0	0	0	0	4	20%	14	70%	13	65%
6/24-6/60	0	0	20	100%	16	80%	6	30%	5	25%
>6/60	20	100%	0	0	0	0	0	0	0	0
					x^2 =147.728					
					df=12					
					p-value =<0.001 (HS)					
Group 3 (Bimanual Phaco) n=20	N	%	N	%	n	%	n	%	n	%
>6/9	0	0	1	5%	1	5%	4	20%	9	45%
6/12-6/18	0	0	18	90%	19	95%	16	80%	11	55%
6/24-6/60	9	45%	1	5%	0	0	0	0	0	0
>6/60	11	55%	0	0	0	0	0	0	0	0
					x^2 = 111.969					
					df=12					
					p-value =<0.001 (HS)					

TABLE V: MEAN PRE AND POSTOPERATIVE CORNEAL ASTIGMATISM AT DIFFERENT TIME INTERVALS.

Corneal astigmatism	**Group 1 Conv. Phaco(n=20)**	**Group 2 Manual SICS(n=20)**	**Group 3 Bimanual Phaco(n=20)**	**P-VALUE**		
Preoperative	0.937 ±0.450	0.45 ±0.208	0.475±0.291	Gp1&2= <0.0001 (HS)	Gp2&3= 0.7563 (NS)	Gp1&3= <0.0001 (HS)
Day 1	1.725 ±0.785	2.737±0.570	0.875±0.275	<0.0001 (HS)	<0.0001 (HS)	<0.0001 (HS)
Day 7	1.3 ±0.719	2.4 ±0.528	0.687±0.267	<0.0001 (HS)	<0.0001 (HS)	<0.0001 (HS)
Day 30	1.212 ±0.694	2.362±0.509	0.687±0.267	<0.0001 (HS)	<0.0001 (HS)	=0.0031 (VS)
Day 90	1.175±0.698	2.35±0.509	0.687±0.267	<0.0001 (HS)	<0.0001 (HS)	=0.0059 (VS)

TABLE VI: DISTRIBUTION OF TYPE OF CORNEAL ASTIGMATISM IN DIFFERENT STUDY GROUP

K value	Group 1 Conv. Phaco(n=20)			Group 2 Manual SICS(n=20)			Group 3 Bimanual Phaco(n=20)		
	ATR	WTR	Nil	ATR	WTR	Nil	ATR	WTR	Nil
Preoperative	15	4	1	16	3	1	15	4	1
Day 1	19	1	0	20	0	0	19	1	0
Day 7	18	1	1	20	0	0	19	1	0
Day 30	18	1	1	20	0	0	19	1	0
Day 90	17	1	2	20	0	0	19	1	0

TABLE VII: MEAN SPHERE VALUES (DIOPTRES) AT DIFFERENT TIME INTERVALS.

Refraction (sphere)	Group 1 Conv. Phaco	Group 2 Manual SICS	Group 3 Bimanual Phaco	P-Value		
Day 30	0.575 ±0.345	0.562±0.27	0.362±0.23	Gp1&2=0.8964 (NS)	Gp2&3=0.0191 (S)	Gp1&3=0.0284 (S)
Day 90	0.4125±0.356	0.537±0.28	0.275±0.27	=22.68 (NS)	=0.0052 (S)	=0.1774 (NS)

TABLE VIII: MEAN CYLINDER VALUES (DIOPTRES) AT DIFFERENT TIME INTERVALS.

Refraction (cylindrical)	Group 1 Conv. Phaco	Group 2 Manual SICS	Group 3 Bimanual Phaco	p-value		
Day 30	1.212±0.694	2.275±0.54	0.687±0.26	Gp1&2= <0.0001 (HS)	Gp 2&3= <0.0001 (HS)	Gp 1 & 3 =0.0031 (S)
Day 90	1.175±0.698	2.262±0.54	0.687±0.26	<0.0001 (HS)	<0.01 (HS)	=0.0059 (S)

TABLE IX: MEAN SURGICALLY INDUCED CORNEAL ASTIGMATISM(SIA) AT DIFFERENT TIME INTERVALS.

SIA	Group 1 Conv. Phaco	Group 2 Manual SICS	Group 3 Bimanual Phaco
Day 1	1.167±0.459	2.38±0.593	0.525±0.111
Day 7	0.742±0.390	2.05±0.529	0.312±0.137
Day 30	0.63±0.383	2.012±0.528	0.312±0.137
Day 90	0.592±0.346	2±0.513	0.312±0.137

TABLE X: DETAILED STATISTICAL EVALUATION OF SURGICALLY INDUCED CORNEAL ASTIGMATISM(SIA) AT DIFFERENT TIME INTERVALS.

	Day 1	Day 7	Day 30	Day 90
Group 1 & 2	t=7.23403	t=8.90042	t=9.47517	t=10.1761
	p=<0.0001 (HS)	p=<0.0001 (HS)	p=<0.0001 (HS)	p=<0.0001 (HS)
Group 2 & 3	t=13.75074	t=14.2237	t=13.9374	t=14.21709
	p=<0.0001 (HS)	p=<0.0001 (HS)	p=<0.0001 (HS)	p=<0.0001 (HS)
Group 1 & 3	t=6.079889	t=4.65213	t=3.496216	t=3.36489
	p=<0.0001 (HS)	p=<0.0001 (HS)	p=<0.0001 (HS)	p=<0.0001 (HS)

FIG. I: MEAN SURGICALLY INDUCED CORNEAL ASTIGMATISM(SIA) AT DIFFERENT TIME INTERVALS..

IV. Discussion & Conclusion

Cataract surgery has evolved remarkably from ICCE-ECCE-phacoemulsification in 1967 to development of foldable IOL in late 1980s.The driving force for this development was a need to remove cataract through a tiny incision for shortening recovery period with minimal postoperative complications. Conventional phacoemulsification is a coaxial system which requires an incision of 2.8-3.5mm for emulsification & implantation of foldable IOL has become gold standard procedure.Its merits include minimal SIA, early & stable visual rehabilitation,reduced tissue trauma & postoperative inflammation. Microincision phacoemulsification is a part of continuing process of evolution & it is claimed to be more safe & effective,less invasive,reducing SIA & surgically induced higher order corneal aberrations,faster having better fluidics with insertion of rollable IOL.

Currently, two methods of MICS are in vogue-Bimanual MICS & Coaxial MICS.MICS was originally developed as bimanual MICS (irrigation & aspiration separated) which has all advantages of MICS but also has disadvantages including end steep learning curve,AC instability, limitation in infusion and vaccum & more mechanical trauma to the wound. Phacoemulsification is the ideal technique for cataract surgery but it has some restrains like expensive instrumentation that,this technique cannot be employed in developing countries whereas M-SICS offers similar advantages with the merits of wider applicability,better safety,a shorter learning curve and lower cost and requires only a minimum addition to the standard cataract surgery instrument armamentarium. Secondly, certain cataracts like hypermature, morgagnian or traumatic cataracts are difficult to handle with phacoemulsification. Whereas M-SICS can be performed in almost all types of cataracts and time spent on every cataract case is almost same. So keeping in mind about these points this prospective randomized study was undertaken to evaluate the results of three different techniques. Most of the patients in our study were between 45 & 65 years with mean age of 55.8333years & was less than other studies like Vasavada etal (65.3years).Maximum number of patients were females (53.33%).The sex ratio in our study matches with the study done by Saber H. et al(53.33% females and 46.67% males).

Preoperative visual acuity was<6/60 in 58.33% of patients in all three groups.Preoperatively75% of patients had a corneal astigmatism of <1D,20% had>1D astigmatism and 5% patients had no astigmatism. Pranda Shukla[5] in his"A study of Astigmatism in Cataract Patients stated the average astigmatism in the present study was 0.842D which is nearly same as astigmatism has been reported by Duke Elder[6] 0.5 - 0.75D,Baseley[7] 0.75D, Luntz[8] 0.75D, Mahesh S.V. et al[9]. 0.42 to 0.77D, Kamlesh et al.[10] 0.83D and Ravindran[11]. Mohammed Isyaku, Syed A Ali, Sadiq Hassan et al [12] in their study"Preoperative corneal astigmatism among adult patients with cataract in Northern Nigeria"showed mean corneal astigmatism was 1.16 diopter and a majority(45.92%) of eyes had astigmatism between1.00and1.99diopters.BCVA was markedly increased on postoperative day1 as compared to preoperative visual acuity in all three groups.It improved slightly more by postoperative day7& subsequently maintained at same level at 1month & 3months follow up.Mean BCVA was 0.19,0.21,0.26log mar value resp.in CCP,BMP&M-SICS on postoperative day1.Thus, mean BCVA was almost similar in BMP & CCP but it was less in M-SICS.It improved gradually over 1week 0.17,0.19,0.26 log mar value resp.in CCP, BMP, MSICS & got stabilized at almost same level by 1month to 0.17,0.19,0.25 log mar value resp.in CCP,BMP,MSICS & remained same even after 3 months(0.17, 0.18, 0.25 log mar values) resp.in CCP,BMP,MSICS.

On postoperative day 1,55% patients of CCP group had UCVA in the range 6/12-6/18 whereas in BMP group 90% patients fell in the range 6/12-6/18 ,while 100% patients of M-SICS group had UCVA in the range 6/24-6/60.By the postoperative day7,85% patients of the CCP group came in 6/12-6/18 range of vision,whereas in BMP group 5% rose to>6/9 vision range & rest 95% fell in 6/12-6/18 vision range & in M-SICS group 20% of the patients rose to 6/12-6/18 vision range rest 80% of the patients remained in 6/24-6/60 vision range.By the postoperative day30,in 20% patients of CCP group, UCVA improved to>6/9,75% patients had vision in the range of 6/12-6/18,rest 5% had vision in the range of 6/24-6/60,whereas in BMP group 20% of the patients vision rose to>6/9rest 80%of the patient had vision in the range of 6/12-6/18,whereas in MSICS group vision improved to 6/12-6/18 in70% patients, whereas in rest 30% patients it remained in the range of 6/24-6/60.On postoperative day90,situation remained almost same as of postoperative day30 with 35% patients having >6/9 vision ,60% having 6/12-6/18 vision and rest 5% in 6/24-6/60 vision range in the CCP group ,whereas in BMP 45% patients having>6/9 vision and rest of 55% patients having 6/12-6/18 vision,in M-SICS group 10% patients started falling in>6/9vision range,65% patients still remained in the 6/12-6/18 vision range and 25% patients fell in 6/24-6/60 vision range group. Wilczynski et al[13] showed no significant difference between postoperative visual acuity in CCP group and BMP group.Abdulrahman-Al- Muammar(2009)[14] in his study"Postoperative Bimanual microincisional cataract surgery technique and clinical outcome" found out that UCVA was better in B-MICS than standard phacoemulsification but not statistically different(Saeed etal.,2008)[15].Alio etal.(2005)[16]found that postoperative UCVA in B-MICS group was better at day 1 and 1month but not at 3months and the differences was not statistically significant. Postoperative BCVA was found to be statistically better with B-MICS than standard phacoemulsification(Kurz etal.,2006)[2].Other studies (Alio et al., 2005[[16]; Kurz et al., 2006[2]; Wilczynski et al., 2006[13]; Crema et al., 2007[17]; Denoyer et al., 2008.) [18] did not find any statistical differences between the two techniques.Saber H. El-Sayed, Amin F. Ellakwa, Nermeen M. Badawi,Abeer M. Wahba etal[19] in their study"Bimanual microincision versus coaxial phacoemulsification cataract surgery" showed that comparison between the difference in mean values of postop VA readings in both groups during the postoperative period using paired *t*-test showed that there was no statistically significant difference. Similarily,no difference in mean values of the postop BCVA readings in both groups. Saber H.El-Sayed, Hoda M.K. El-Sobky, Nermeen M.Badawy, Eslam A.A.El-Shafy et al (2013)[20]in their study "Phacoemulsification versus M-SICS for treatment of cataract" concluded that the initial visual recovery on the first postoperative day was better in the patients who underwent phacoemulsification with the UCVA better than or equal to 6/18 in75% patients, whereas the percentage was 60% in the M-SICS group.The initial difference was nearly equalized within 4 weeks. At the 3rd month,75% of the patients in the MSICS group had UCVA better than or equal to 6/18 versus 90% of the patients in the phacoemulsification group(P>0.05).

Postoperative corneal astigmatism on day1:1.7D ,0.87D, 2.7 D in CCP,BMP,M-SICS resp. It was gradually decreased on postoperative day7,itbecame1.3D,0.69D,2.4D in CCP,BMP,M-SICS resp. Gradually over a period of a month it stabilized to around1.2D,0.69D,2.4D, in CCP,BMP,M-SICS resp which remained almost same over 90 days follow up visit.

Postoperatively majority of the patients in all three groups converted into ATR (Against the Rule) type of astigmatism. Mean postoperative surgically induced corneal astigmatism increased significantly on day 1 as compared to preoperative astigmatism in all three groups. It was found to be 1.2D,2.4D,0.5D on day 1postoperatively,which decreased to 0.7D,2.0D,0.3D in CCP,M-SICS, BMP resp. on day7 postoperatively and stabilized to around 0.6D,2.0D,0.3D on day30 postoperatively it remained almost same by day 90.When CCP was compared with M-SICS difference in SIA was highly significant statistically, similarly when BMP was compared with M-SICS difference in SIA was highly significant statistically but when CCP group was compared to BMP it was significant statistically. Axis of SIA was ATR type in most of the patients.

We waited for a month for the refraction to get stabilized with SIA to settle down with all the postoperative complications. On day 30 refraction, the mean sphere(D) in CCP,BMP and M-SICS was 0.58D, 0.36D,0.56D respectively, whereas on day 90 postoperatively the results were0.41D,0.27D,0.54D respectively. When CCP group was compared with M-SICS on day90 sphere value result was not significant statistically but when BMP group was compared with M-SICS group result was significant statistically, but whereas when CCP group was compared with BMP group result was not significant statistically. Similarly for cylindrical power, refraction on day30 and 90postoperatively was done & result was as follows in CCP ,BMP and M-SICSwas1.2D,0.69D,2.3Drespectively,whereas on day90 postoperatively when refraction got further settled and stabilized the results were 1.1D,0.69D,2.3D respectively.When CCP group was compared with M-SICS on day90 cylinder prescription value result was highly significant statistically whereas when BMP group was compared with M-SICS group result was highly significant statistically. But again when CCP group was compared with BMP group result was significant statistically. Our SIA findings correlate with the conclusion of Saber H. El-Sayed, Amin F. Ellakwa, Nermeen M. Badawi, Abeer M. Wahba etal[19] who compared Bimanual microincision versus coaxial phacoemulsification cataract surgery and found that the bimanual group demonstrated a reduced SIA.The coaxial group demonstrated a slight rise in SIA. There is a highly significant difference between postoperative SIA in both groups during the postoperative period (P < 0.001). Yao etal. (2006)[21] measured the change in simulated keratometry values. The mean postoperative ΔSim$K$ value was 0.78 ± 0.38 D for B-MICS group and1.29 ± 0.68 D for the standard group.The difference between the two groups was statistically significant(P = 0.001).The optical quality of the cornea is essential to good vision (Elkady etal. 2008)[22].Since B-MICS has less SIA in comparison with standard phacoemulsification which might be associated with better optical quality. Wilczyńska O,Wilczyński M,Omulecki W[23], in their article on SIA after bimanual phacoemulsification through microincision and after standard phacoemulsification showed that in vector method SIA did not differ significantly between the groups during the whole follow-up. In vector decomposition method, SIA was higher in group 2 than in group 1, one day and 1month postoperatively.Cravy's and Naeser's method showed that SIA in group 2 was significantly higher as long as the 1-st month postoperatively.In the final examination,there was no significant difference in SIA values. Jia-yu Zhang,Yi-fan Fen and Jian-qiu Cai[24] in their study on Phacoemulsification versus M-SICS for age-related cataract :meta-analysis of randomized controlled trials showed Six RCTs describing a total of 1315 eyes were identified.There were no significant differences between the techniques regarding the BCVA 6/9 or better ($P = 0.69$)and less than 6/18($P = 0.68$),intraoperative or postoperative complications($P = 0.44$and $P = 0.87$,respectively). However, a greater proportion of patients in the PE group had final UCVA $\geq$ 6/9($P = 0.03$), whereas a greater proportion of patients in the M-SICS group had final UCVA $<$ 6/18($P = 0.03$).Moreover, PE group induced less SIA ($P < 0.00001$).Pavan Panjabrao Chavan , H.T.Karad, T.R. Gitte,Varsha R. Dhakne[25] in their study on"A comparative study of sub 3mm and 5.25 mm incisions in patients undergoing cataract surgery with respect to post operative visual acuity and refractive errors" shows statistically significant difference in the mean SIA between two types of surgery, highlighting that decreasing size of incision induces less astigmatism. In M-SICS, astigmatism is higher due to large size of incision >5.25mm.In both >5.25mm incision where we performed manual SICS and<3.00mm incision where we performed Phacoemulsification, postoperative astigmatism is mostly of ATR type,which is caused by postoperative flattening of vertical meridian as in both types of surgery there is superiorly placed incision. Thus, final conclusion came out to be group 3 i.e. BMP produced least SIA followed by group1 i.e. CCP followed by group 2i.e.MSICS which produced maximum SIA among these three techniques. Thus, BMP became surgery of choice for performing cataract extraction as it has many advantages but it is limited by the lack of suitable intraocular lenses for implantation through microincisions as they are expensive and it was difficult in our government set-up for patients to afford such expensive IOLs; hence, switching to this technique from the conventional one still depends on the surgeon's performance and other economic factors in consideration & the advancement in IOL Technology available & its cost effectiveness. So, that in future it can become gold standard technique.

References

[1]. Ruit R, Tabin G, Chang D, et al. A prospective randomized clinical trial of phacoemulsification versus manual sutureless small-incision extracapsular cataract surgery in Nepal. Am J Ophthalmol 2007; 143:32–38.

[2]. Kurz S, Krummenauer F, Gabriel P, Pfeiffer N, Dick HB Biaxial microincision versus coaxial small-incision clear cornea cataract surgery. Ophthalmology 2006; 113:1818–1826.

[3]. Jean, Claude. Bimanual micro-incision phacoemulsification the way forward. l'ophthalmographe 2005;22:4–5.

[4]. Ravindran RD, Haripriya A, Minu M. In:Ashok G, Luther L, Geoffery T, et al. editors. Relevance and clinical significance of SICS (manual phaco) in modern cataract surgery.Clinical practice in small incision cataract surgery (phaco manual). 1st ed. Jaypee Brothers;2005. 238–240

[5]. A study of Astigmatism in Cataract Patients September 2014; 1(9): 514-516. http://www.medpulse.in.

[6]. Duke Elder W.S. system of ophthalmology volume vth ophthalmic optics refraction 95-128

[7]. Baseley C.H. keratomertic changes after cataract surgery. Trans. Amer. Opthal. Soc.65, 168-188(1967).

[8]. Luntz M.H. and Livingston D.G. astigmatism in cataract surgery Br. J. Ophthal. 61, 360-5(1977)

[9]. Mahesh S.V. and Rao P.N. role of suturing and incision in astigmatism following cataract surgery Ind. J. ophthal. 32, 488-490(1984)

[10]. Kamlesh and Bihari V., "Role of multiples sutures in cataract surgery to control the corneal astigmatism". Ind.J.Ophthal. 31, 978-982(1983).

[11]. Ravindran R.D. evaluation of corneal astigmatism following wound closer with continues suture. Proc.AIOS Bangalore (1991).

[12]. Mohammed Isyaku, Syed A Ali, Sadiq Hassan et al in their study"Preoperative corneal astigmatism among adult patients with cataract in Northern Nigeria" Department of Ophthalmology, Aminu Kano Teaching Hospital, Kano, Nigeria Department of Optometry, Makkah Specialist Eye Hospital, Albasar Foundation, Kano, Nigeria,Indian J Ophthalmol. 2014 Nov; 62(11): 1094–1095;doi: 10.4103/0301-4738.146751;

[13]. Wilczynski M., Drobniewski I., Synder A., Omulecki W. Evaluation of early corneal endothelial cell loss in bimanual microincision cataract surgery (MICS) in comparison with standard phacoemulsification. Eur. J. Ophthalmol. 2006;16(6):798–803.

[14]. Abdulrahman-Al- Muammar(2009); Postoperative Bimanual microincisional cataract surgery technique and clinical outcome; Saudi Journal of Ophthalmology (2009) 23, 149–155

[15]. Saeed A., O'Connor J., Cunnife G. Uncorrected visual acuity in the immediate postoperative period following uncomplicated cataract surgery: bimanual microincision cataract surgery versus standard coaxial phacoemulsification. Int. Ophthalmol. 2008 [PubMed]

[16]. Alio J., Rodriguez-Prats J.L., Galal A., Ramzy M. Outcomes of microincision cataract surgery versus coaxial phacoemulsification. Ophthalmology. 2005;112(11):1997–2003. [PubMed]

[17]. Crema A.S., Walsh A., Yamane Y., Nose W. Comparative study of coaxial phacoemulsification and microincision cataract surgery. One-year follow-up. J. Cataract Refract. Surg. 2007;33(6):1014–1018. [PubMed]

[18]. Denoyer A., Denoyer L., Marotte D. Intraindividual comparative study of corneal and ocular wavefront aberrations after biaxial microincision versus coaxial small-incision cataract surgery. Br. J. Ophthalmol. 2008 [PubMed]

[19]. Saber H El-Sayed, Amin F Ellakwa, Nermeen M Badawi, Abeer M Wahba. Bimanual microincision versus coaxial phacoemulsification cataract surgery. Year : 2015 | Volume : 28 | Issue : 1 | Page : 162-167.

[20]. Saber H El-Sayed, Hoda MK El-Sobky, Nermeen M Badawy, Eslam AA El-Shafy. Phacoemulsification versus manual small incision cataract surgery for treatment of cataract. Year : 2015 | Volume : 28 | Issue : 1 | Page : 191-196.

[21]. Yao K, Tang X, Ye P. Corneal astigmatism, high order aberrations, and optical quality after cataract surgery: microincision versus small incision. J Refract Surg. 2006 Nov; 22(9 Suppl):S1079-82

[22]. Elkady B, Alió JL, Ortiz D, Montalbán R. Corneal aberrations after microincision cataract surgery. J Cataract Refract Surg. 2008 Jan; 34(1):40-5.

[23]. Wilczyńska O, Wilczyński M, Omulecki W. Klin Oczna. Surgically induced astigmatism after bimanual phacoemulsification through microincision and after standard phacoemulsification. 2010;112(4-6):115-9. Polish. PMID: 20825064.

[24]. Jia-yu Zhang, Yi-fan Feng, Jian-qiu Cai. Phacoemulsification versus manual small-incision cataract surgery for age-related cataract: meta-analysis of randomized controlled trials. Clinical & Experimental Ophthalmology 2013, 41 (4): 379-86

[25]. Pavan Panjabrao Chavan, H. T. Karad, T. R. Gitte, Varsha R. Dhakne. A comparative study of sub 3mm and 5.25+mm incisions in patients undergoing cataract surgery with respect to post operative visual acuity and refractive errors. Volume 3, No. 2, July-Dec 2013 Journal of Medical Education and Research ISSN No. 2249-9660