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OUTCOME COMPARISON OF TORSIONAL MICROCOAXIAL PHACOEMULSIFICATION USING 30 AND 45 DEGREE APERTURE ANGLE NEEDLE

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ABSTRACT **Aims:** To assess and compare the postoperative outcomes of torsional microcoaxial phacoemulsification surgeries performed using 30 and 45 degree aperture angled needles.

Materials and methods: This randomized, single blinded comparative follow up study was conducted on 80 patients attending Eye OPD diagnosed with uncomplicated senile cataract.

Result & analysis: Group A (40 eyes of 40 patients) underwent coaxial torsional phacoemulsification using 45 degree aperture angle & Group B (40 eyes of 40 patients) using 30 degree aperture angle. Both the groups were similar in terms of age, sex, cataract grade and the eye which was operated. (P> 0.05 for each of them).We found lower values of CDE and total UST during the surgery in Group A which were statistical significance with P values =0.0010 and 0.027s respectively. Volume of BSS used in group A was high than in group B but the difference was not statistically significant with P values = 0.214. Mean Endothelial cell loss was higher in Group B in all postoperative visits of 1 week, 1 month and 3 month but this difference was statistically significant only at 1 week post op with P value 0.04 at 1 week , 0.248 and 0.815 at 1 month and 3 month respectively. We found better values of BCVA in group A than group B but the difference was not statistically significant with P values at 1 week, 1 month , and 3 month were 0.20 , 0.09, 0.546 and 0.058 respectively.

Conclusion : This suggest that phacoemulsification using 45 degree needle may be slightly superior than 30 degree in terms of total energy dissipated in eyes but the final clinical result is not clinically significant or superior.

KEYWORDS : .torsional phacoemulsification, endothelial cell, cataract.

Introduction: Cataract surgery is the second most common surgery performed after caesarean section in India**.** Phacoemulsification is the main procedure of modern cataract surgery. Because cataract surgery is already such a fast and efficient operation, new technologies are primarily interested in that can expand our margin of safety — particularly in eyes with dense nuclei and weak zonules. In torsional phacoemulsification machine, there is a side to side movement of the phacoemulsification tip thereby reducing the repulsion of the lens fragments. In torsional mode, tip selection plays a very vital role. In general, the surgeon chooses the bevel angle of the phaco tip based on his personal preference. The standard tip is straight with a bevel angle of 0, 15, 30 or 45 degree. A tip with a greater bevel angle has an oval shaped port with a larger surface area. Since pressure is defined as force per unit area, the tips with greater surface area can generate greater adherence of nuclear material. Those ranging from 0 to 15 degree do not cut that much but they occlude more easily, therefore they are ideal for soft cataracts and for some chopping techniques in which a maximum capacity for occlusion and high vacuum is necessary. Tips with more angulation and bevel such as 45 degrees have a high capacity to cut the tissues and occlusion is harder to achieve, therefore they are very useful in dense cataracts.

Aims: To assess and compare the postoperative outcomes of torsional microcoaxial phacoemulsification surgeries performed using 30 and 45 degree aperture angled needles in terms of CDE **,**total UST **,**BSS used**,** CCT**,** Endothelial cell count**,** BCVA.

Materials and methods: This Hospital based randomized, single blinded comparative follow up study conducted on patient attending Eye OPD diagnosed with uncomplicated senile cataract. This study was conducted among 80 patients in two groups: 40 in group A and 40 in group B after excluding patients who didn't meet the inclusion criteria and the dropouts. Cataract patients between 50 – 70 years with cataract nuclear grade 1-3 (LOCS III) & central corneal endothelial cell density (ECD) higher than 1500 cells/mm^2 recruited. Patients with high refractive errors, corneal pathologies, pseudoexfoliation, history of intraocular surgery, zonular weakness, diabetic retinopathy, senile macular degeneration, glaucoma and uveitis, patients on drugs affecting pupil size, history of ocular trauma were excluded from study. The patients allocated into the 2 groups by the process of randomization using the chit method. Preoperatively all patients examined with complete history, full Ophthalmological check up including BCVA on Snellen's Chart, Tonometry, endothelium examination by slit lamp with 16X magnification and fundus examination, keratometry (manual),A scan and IOL power calculation. Specular microscopy study with Topcon SP-3000P specular microscope for endothelial cell count & central corneal thickness. Preoperatively blood sugar (fasting or random), Urine complete, ECG was done. Preoperatively Ciprofloxacin 0.3% eye-drops-given 2 hourly in the eye to be operated & Tab Ciprofloxacin 500mg b.d. for 3 days. All surgeries was performed by the same surgeon, using the infiniti vision phaco system (Alcon laboratories, inc.) with the enhanced phaco (OZIL IP-intelligent phaco) software. Dilatation of pupil was done by instillation of topical tropicamide with phenylephrine drops. After dilatation peribulbar block with lignocaine, hyaluronidase and bupivacaine was given. **GROUP A** (40 eyes of 40 patients) underwent coaxial torsional phacoemulsification using 45 degree aperture angle needle. **GROUP B** (40 eyes of 40 patients) underwent coaxial torsional phacoemulsification using 30 degree aperture angle needle. In both groups all cases were operated by the same surgeon and similar type of IOL was implanted. A single 0.9 mm side port was created at 12 o,clock in right eyes and 6 o clock in left eyes using 15 degree lance tip. After injecting tryphan blue dye, anterior chamber was washed with saline and then formed with ophthalmic viscoelastic device (OVD). Main biplane clear corneal incision was created temporally using a 2.2 mm keratome. A continuous curvilinear capsulorhexis was performed using a capsulorhexis forceps. Hydrodissection and hydrodelineation was done. Phacoemuslification with Alcon Infiniti machine using direct chop technique along with cortical aspiration. After filling the AC with OVD, an aspheric, biconvex, hydrophilic, foldable, acrylic IOL with the recommended injector system was implanted in to the eye. Finally OVD was removed with the I/A tip and the wound was hydrated. Intra Operative details like CDE, total UST and BSS used was noted. Postoperative medication tobramycin 0.3% and dexamethasone 0.1% eye drop 2 hourly for 48 hrs followed by four times a day for 1 week ,three times a day for 1 week , twice a day for 1 week ,once daily for 1 week. Patients with intraoperative complications like failure to place IOL in the bag, zonular dehiscence ,posterior capsular rent, vitreous loss & postoperative complications like endopthalmitis ,TASS ,uveitis, secondary glaucoma were excluded from study. Patients with any intra or post operative complications were excluded from the

study. All cases were followed upon post operatively on 1 week, 1 month and 3 month after surgery and **UCVA, BCVA, CCT**(central corneal thickness) , endothelial cell count **(ECC)** were noted. All the readings was performed by a single observer to avoid bias, both pre and postoperatively. Cell loss would be expressed as a percentage of preoperative cell density.

Outcome Analysis- Qualitative data was expressed in variables in proportion. **Quantitative data** was expressed in variables in mean. Significance of difference in proportion was inferred by Chi square test. Significance of difference in mean was inferred by unpaired t test. P value of less than 0.05 was considered statistically significant.

Observations:

Table No. 1: Distribution of Patients According to Age in Both Groups

	Group A(N=40) (45 degree)	Group B(N=40) (30 degree)
Mean age (years)	60.55	60.93
S.D. (years)	5.44	6.57
Maximum age (years)	70	70
Minimum age (years)	50	50

Table No. 2: Distribution of the Patients According to Type of Cataract in Both Groups

Cataract Grade	Group A		Group B		Total	
	No	%	No	%	No	%
1	6	15	4	10	10	12.5
2	19	47.5	19	47.5	38	47.5
3	15	37.5	17	42.5	32	40
Total	40	100	40	100	80	100

No significant difference was observed among the groups according to cataract grading with Chi-square = 0.525 with 2 degrees of freedom and; P value = 0.769.

Table No. 3: Distribution of the Patients According to Cumulative Dissipated Energy (CDE) in Both Groups

	Group A (N=40)	Group B (N=40)
Mean	5.99	10.40
S.D.	2.01	2.33
Maximum	10	15
Minimum	3	5

Table no. 3 shows that the mean CDE in Group A was 5.99±2.01 while in Group B was10.40±2.33(5 to 15).The mean CDE was significantly less in Group A as compared to group B with P value =0.001.

Table No. 4: Volumes of Balanced Salt Solutions (BSS) used in Both Groups

BSS	Group A (N=40)	Group B (N=40)
Mean(ml)	60	63.25
S.D.	11.323	11.85
Maximum	80	80
Minimum	40	40

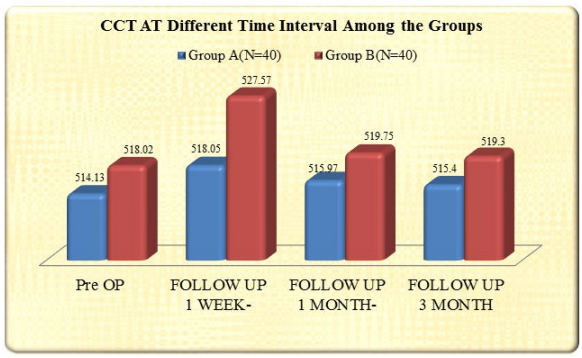
Table no. 4 shows that in Group A, the mean volume of BSS used was 60±11.323ml, while in Group B the mean volume of BSS used was 63.25±11.85. The mean volume of BSS was lower in Group A, but this was statistically not significant with P value =0.214.

Table No. 5 Total UST in Both the Groups

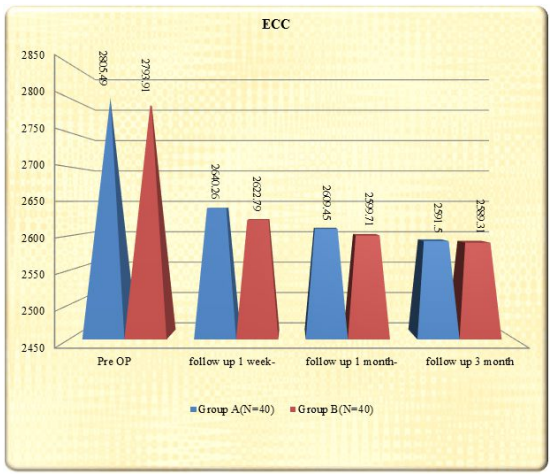
Total UST	Group A	Group B
Mean (sec.)	58.09	63.43
S.D.	11.84	9.24
Maximum	72.91	89.40
Minimum	21.81	45.40

Table no. 5shows that in Group A, the mean UST was 58.09± 11.84, while in Group B the mean UST was 63.43 ±9.24. The mean UST in Group A was significantly lower than Group B with P value =0.027s

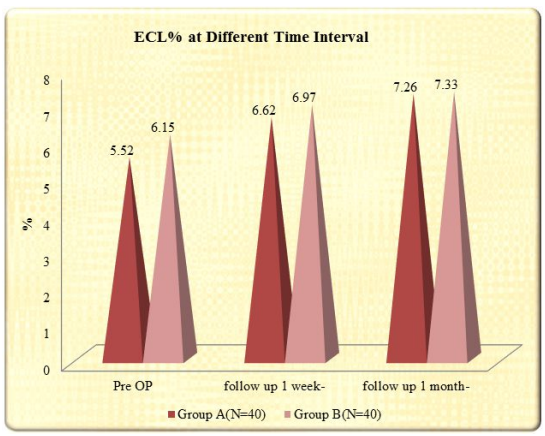
Graph 1: Central Corneal Thickness in Group A and B



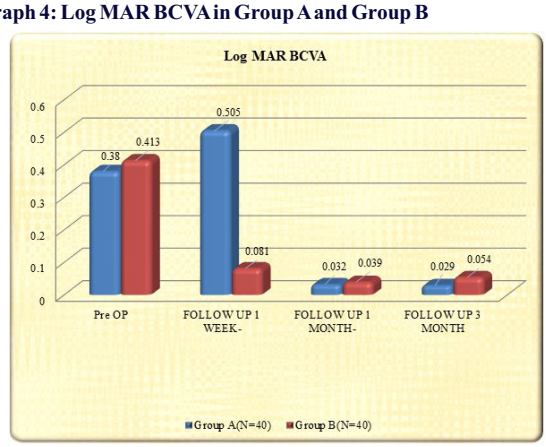
Graph 2: Endothelial Cell Counts in Group A and Group B



Graph 3: Endothelial Cell Loss (ECL%) in Group A and Group B



Graph 4: Log MAR BCVA in Group A and Group B



Discussion

Group A (45 degree) had 40 eyes of 40 patients and Group B (30 degree) had 40 eyes of 40 patients. The mean age of patients in Group A was **60.55±5.44** (50 to 70) and Group B was **60.93±6.57** (50 to 70) with P value=**0.78.** In **group A** 62.5% were male and 37.5% were female while in **group B** 49% were male and 31% were female. In **Group A** 45% cases were right eyes and 55% cases were left eyes, while in **Group B** 47.5% cases were right eyes and 52.5% cases were left eyes. In **Group A**, out of 40 patients 6 patients had grade 1, 19 patients had grade 2 and 15 patients had grade 3 cataract, while in **Group B** out of 40 patients 4 patients had grade 1, 19 patients had grade 2 and 17 patients had grade 3 cataract with P value 0.769. Therefore both the groups were similar in terms of age , sex , cataract grade and the eye which was operated. (P> 0.05 for each of them).

In this study, the mean CDE in Group A was 5.99±2.01 while in Group B was10.40±2.33(5 to 15).The mean CDE was significantly less in Group A as compared to group B with P value =0.001. Therefore the mean CDE was lower in 45 degree group not only as whole but also for all cataract grades separately. In this study, the mean volume of BSS used in Group A was 60±11.323ml, while in Group B the mean volume of BSS used was 63.25±11.85. The mean volume of BSS was lower in Group A, but this was statistically not significant with P value =0.214.

In this study the mean endothelial cell count (ECC) in Group A preoperatively was 2805.49±450.55/ mm^3. Postoperatively, the mean ECC at 1 week was 2640.26±421.84 /mm^3, which reduced to 2609.45±415.70 and 2591.5±413.00/ mm^3 1 month and 3 month respectively while in Group B the mean Endothelial cell count (ECC) preoperatively was 2793.91±440.22/ mm^3. Postoperatively, the mean ECC at 1 week was 2622.79±416 /mm^3, which reduced to 2599.71±412.83 and 2589.31±410.36 / mm^3 1 month and 3 month respectively. There was no statistically significant difference between cell counts in two groups. Mean Endothelial cell loss was higher in Group B in all postoperative visits of 1 week , 1 month and 3 month but this difference was statistically significant only at 1 week post op with P value 0.04 at 1 week , 0.248 and 0.815 at 1 month and 3 month respectively.

In this study the mean UST in Group A was 58.09± 11.84, while in Group B the mean UST was 63.43 ±9.24. The mean UST in Group A was significantly lower than Group B with P value=0.027s.

In this study the mean central corneal thickness (CCT) in Group A preoperatively was 514.13±29.92 microns. Postoperatively, the mean CCT at 1 week was 518.05±29.72 microns which reduced to 516.53±29.57 microns and 516.4±30.013 microns at 1 month and 3 month respectively, while in Group B the mean central corneal thickness (CCT) preoperatively was 518.02±18.82 microns. Postoperatively, the mean CCT at 1 week was 527.57±15.45 microns which reduced to 527.57±15.45 microns and 519.30±19.05 microns at 1 month and 3 month respectively. The mean change in CCT from pre-op to 1 week in Group-A was 3.93 and in Group B was 9.60 that was significantly low with P value of 0.017. While mean change in CCT from pre- op to 1 month and 3 month in Group A was 1.85 and 1.28 and in Group B was 2.0 and 1.47 with P value of 0.65 and 0.39 respectively with no statistically significant difference.

In this study there was no statistically significant difference in preoperative and respective postoperative Log MAR BCVA between two groups. P values preoperatively and postoperatively at 1 week , 1 month , and 3 month were 0.20 , 0.09, 0.546 and 0.058 respectively.

SUMMARY AND CONCLUSION

This study was conducted in the Upgraded department of Ophthalmology, SMS Medical College, JAIPUR. The study included a total of 80 patients: 40 patients in group A and 40 patients in group B.

Group A (40 eyes of 40 patients) underwent coaxial torsional phacoemulsification using 45 degree aperture angle.

Group B (40 eyes of 40 patients) underwent coaxial torsional phacoemulsification using 30 degree aperture angle.

Both the groups were similar in terms of age, sex, cataract grade and the eye which was operated. (P> 0.05 for each of them).

We found lower values of CDE and total UST during the surgery in Group A which were statistical significance with P values =0.0010 and .027s respectively. These values suggest that lesser energy is dissipated in the eye during surgery done with 45 degree aperature angle needle when compared to 30 degree aperature angle needle.

Volume of BSS used in group A was high than in group B but the difference was not statistically significant with P values = 0.214.

The value of mean change in CCT from pre- op to 1 week in Group-A was significantly low in group A than group B with P value of 0.017. The mean change in CCT from pre- op to 1 month and 3 month in Group A was low than group B but the difference was not statistically significant with P values = 0.65 and 0.39 respectively.

Mean Endothelial cell loss was higher in Group B in all postoperative visits of 1 week, 1 month and 3 month but this difference was statistically significant only at 1 week post op with P value 0.04 at 1 week , 0.248 and 0.815 at 1 month and 3 month respectively.

We found better values of BCVA in group A than group B but the difference was not statistically significant with P values at 1 week, 1 month , and 3 month were 0.20 , 0.09, 0.546 and 0.058 respectively.

This suggest that phacoemulsification using 45 degree needle may be slightly superior than 30 degree in terms of total energy dissipated in eyes but the final clinical result is not clinically significant or superior.

Procedures of modern cataract surgery aims not only to safely remove the opaque lens without causing any significant change in anatomy or physiology of the eye but also targets to provide the best visual outcome. This need to provide the best visual outcome inspires the creation of newer technology including improvements in the machines and their software. Though the newer machines and software may claim better physics and fluidics during surgery they may not necessarily alter the visual outcome significantly , as we found in our study.

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