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Comparison of corneal changes between SICS and phacoemulsification

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Introduction

Small incision cataract surgery has become an attractive alternative to phacoemulsification in past few years chiefly because of its cost effectiveness & good results comparable to phacoemulsification, however the post operative changes in cornea like corneal endothelial count, thickness & curvature vary according to the technique used.

Aims and Objectives

This study aims to compare corneal changes namely

1. Central corneal endothelial changes, which include
- Average cell area
- Coefficient of variance
- Cell density
2. Central corneal thickness.
3. Corneal curvature (Surgically Induced Astigmatism)

After clear cornea temporal section Phacoemulsification using quick chop technique with foldable IOL implantation and temporal section small incision cataract surgery by sandwich technique with non foldable IOL implantation.

Materials and Methods

Type of study: This is prospective clinical study undertaken at Sankara Eye Centre, Coimbatore during the period November -2004 to October 2005.

Fifty eyes of 50 patients were selected for cataract surgery. They were divided into two groups of 25 patients each.

In group I of 25 patients, temporal clear corneal phacoemulsification was performed with 3mm incision and foldable acrylic/ silicon IOL implantation.

In group II of 25 patients, Small Incision Cataract Surgery (SICS) was done with sandwich technique using 6.5 mm temporal scleral tunnel incision and 6.0 mm optic PMMA IOL implantation.

All surgeries were performed by a single surgeon equally experienced in both SICS & Phacoemulsification, surgical procedures being standardized. Results were evaluated at the end of the study.

Corneal changes in all patients were evaluated pre operatively and post operatively on, day 1, 1 month & 6 months.

Inclusion criteria

- Patients between age 40 to 80 years.
- Either sex.
- Senile cataract.

Pre Op examination was done

- Keratometry was done with TOPCON KR8800 Auto kerato-refractometer.
- Pre & post Op central corneal endothelial cell counts & central corneal thickness was measured with TOP-CON SP 2000 non contact Specular Microscope.

Surgical technique

Anaesthesia: Peribulbar anaesthesia

Procedure for phacoemulsification

1. A side port made with 24 G lance tip knife.
2. Clear corneal section was made using a 3mm keratome.
3. Viscoelastics material (HPMC 2%) was injected into anterior chamber.
4. CCC was done with bent 26G needle.
5. Hydro dissection was done using balanced salt solution.
6. Phacoemulsification performed using direct chop.
7. Cortical matter aspirated with I/A probe and foldable IOL implanted in the bag with injector and AC formed with saline. IOL implanted were Acrylic (Sensar, Aurofold), silicon (Clariflex)
8. All surgeries were performed using Ziess Microscope Opmi1-FR and Opticon phaco machine.

Procedure for SICS

1. Conjunctival peritomy done at temporal side.
2. 6.5 mm 3 plane straight scleral tunnel incision was made 2mm behind limbus.
3. Viscoelastics material (HPMC 2%) was injected into anterior chamber.
4. CCC was done with bent 26G needle.
5. Hydro dissection was done using balanced salt solution.
6. Nucleus delivery done by sandwich technique using Sinsky's hook and wire vectis.
7. Cortical matter aspirated with Simcoe canula and 6.00 mm PMMA IOL implanted in the bag with Mc Pherson's forceps and AC formed with balance salt solution. IOL implanted were Appalens, Excel.
8. All surgeries were performed using Ziess Microscope Opmi1-FR

Post Operative Evaluation: Post operatively endothelial parameters by specular microscope and astigmatism by autokeratometry were analyzed.

The patients were called at one month and 6months post operatively and the same parameters were analyzed.

Observation

Total 61 eyes of 61 patients were studied. Data of 50 eyes included and followed up in the study were analyzed and presented in this report.

All figures presented are numbers and percentages with appropriate graphs (bar). Corneal measurements are expressed as mean 1SD with range wherever applicable.

The cornea measurements taken immediately after surgery, at one month follow-up and 6 months follow-up were individually compared with the corresponding preoperative values of each eye. Then the parameters of phacoemulsification group were compared to respective parameters of SICS group. Paired t test was used to test the significance of each comparison.

There was no clear picture of cornea on 1st post-op day in one eye to evaluate corneal morphology. Similarly, at six months there were 11 patients lost for follow-up, and were excluded from the study. Thus the number of eyes used for paired comparison of corneal measurements between preoperative and immediate postoperative, 1 month and 6 months is 49 (1case, no clear picture on 1st post-op day), 50 (all eyes were present and had clear picture) and 50 respectively.

Of the 11 patients who lost follow-up of 6 months, 2 cases had posterior capsule rupture while cortex irrigation and aspiration. Both the cases were from the SICS group. Anterior vitrectomy was done, and PCIOL was placed in both the cases, and wound was closed with one suture each. These cases were excluded from the study.

Results

Analysis of Paired Observations

Cell Area: The difference between cell area of phaco and SICS group on immediate postoperative, 1 month and 6 months was not statistically significant (all p>0.05).

Table 1: Mean % Change in Cell area Compared to Preoperative Status

	PHACO	SICS
1st day	0.61	-0.15
1M	6.17	4.54
6M	5.26	10.38

Coefficient of Variation (CV): The difference between change in CV observed on 1st postoperative day was statistically significant (p<0.05), though the change in CV observed during 1 month and 6 months was statistically not significant (p>0.05).

Table 2: Mean % Change in Coefficient of Variation Compared to Preoperative

	PHACO	SICS
1st day	8.64	-6.87
1M	-2.73	-9.76
6M	-8.2	-16.46

Cell Density (CD)

There was statistically significant change in the cell density (Table 7) at immediate postoperative, 1month and 6 months (p<0.05) in each group. But the difference in change in CD between two groups was statistically not significant (p>0.05).

Table 3: Mean % Change in Cell Density Compared to Preoperative Status

	PHACO	SICS
1st day	-3.61	-4.57
1M	-6.48	-7.95
6M	-9.00	-11.13

Corneal Thickness (CT): An increase in the corneal thickness was observed postoperatively (Table 4). The difference in change in CT between the two groups was not statistically significant (p>0.05).

Table 4: **Mean % Change in Corneal Thickness Compared to Preoperative Status**

	PHACO	SICS
1st day	5.32	4.23
1M	1.74	1.48
6M	0.73	1.14

Astigmatism

Surgically induced astigmatism: In phaco group, the mean SIA was 0.68D while in SICS group, it was 1.01D at the end of 6 months. Statistically, this difference of the mean surgically induced Astigmatism between the two groups was significant (P< 0.001).

Table 5: Surgically induced astigmatism in dioptres

	PHACO	SICS
1st day	0.68	1.28
1M	0.61	1.03
6M	0.68	1.01

Discussion

Pre-operative astigmatism

Average Native Astigmatism:

Phaco group: 0.93 D

SICS group: 1.11 D

This is higher than, 0.5 to 0.75 D by Duke – Elder[1] and 0.74 D & 0.84D of Bidaye[2]. 0.75 D by Beasely[3]

In this study all the surgeries were done using temporal section.

The advantages of temporal section as documented by *Vanaja Vaithianathan, Sivakumar*[1]

- Astigmatism induction is low
- Neutralizes pre existing astigmatism in most of the cases
- Superior rectus suture is not necessary.
- Provides lot of space in cases with sunken eye balls
- Since visual axis is slightly decentred nasally temporal limbus is a little further away than superior limbus, hence incisions on this have less effect on visual acuity. Corneal topography has proved it.

They also concluded that the uncorrected visual acuity was best in temporal phaco cases and induced astigmatism was the least in temporal phaco & this induction did help in neutralizing pre existing ATR astigmatism.

There are several other studies documenting advantages of temporal section.[5,6,7]

Post-operative astigmatism

Incidence of Astigmatism: In phaco group as well as SICS group, incidence of astigmatism 6 months post operatively was 100%.

Mean surgically Induced Astigmatism (SIA) in both groups: In our study, in phaco group, the mean SIA was 0.68D while in SICS group, it was 1.01D. Statistically, this difference of the mean surgically induced Astigmatism between the two groups was significant (P< 0.001).

Table 7: SIA found in different studies

Sr. No.	Study	SIA (D)			
		Phaco	SICS	ECCE	Duration
1	Present study	0.68	1.01	-	6 months
2	*Parikshit Gogate*[5]	0.84	0.95	-	6 weeks
3	*Navratan Dhanuka*[6]	0.5 or less	0.5 - 1	-	45 days
4	*DJ Pandey et al*[7]	-	1.0	1.5	-
5	*Dam-Johansen*[8]	0.91	-	1.30	-

Limitations of the study

- Main draw back of this study is that the surgeons performing the surgeries as well as the post operative analysis were not masked which could have induced bias.
- Though the non contact specular microscope used is an accepted method for analysis of endothelial function more precise measurements could have been possible with the use of sophisticated techniques like confocal microscopy or optical low coherence reflectometry.

Summary

A prospective study conducted at Sankara Eye Hospital, Coimbatore over a period of one year, from November 2004 to October 2005, evaluated 25 eyes undergoing phacoemulsification and 25 undergoing SICS. The post operative cell density, mean cell area, coefficient of variation and corneal thickness in the phaco group were compared to pre operative values as well as to the same parameters of SICS group. The study showed the following observations at the end of 6 months.

Table 8: The % changes in the parameters found at 6 months follow up

Parameters	Change in Phaco group	Change in SICS group
Cell area	+5.26%	+10.38%
Coefficient of variation	-8.2%	-16.46%
Corneal cell density	-9.00%	-11.13%
Central corneal thickness	+0.73%	+1.14%
Surgically induced astigmatism	0.68 D	1.01 D

1. On 1st post op day, a marginal increase of central corneal thickness by 5.32% and 4.23% was found in phaco and SICS group respectively. The central corneal thickness returns to almost pre operative values by the end of 6 months.
2. Corneal endothelial cell loss was found to be 9% in phaco group and 11.13 in SICS group. The difference in the mean endothelial cell loss in the two groups was statistically insignificant. (P > 0.05)

3. The mean surgically induced astigmatism was lesser in phaco group than in SICS. In phaco group the mean surgically induced astigmatism (SIA) was 0.68D with standard deviation of 0.30. In SICS group, the mean SIA was 1.01D with a standard deviation of 0.41. The difference in the mean surgically induced astigmatism in the two groups was statistically significant. ($P < 0.05$).

Conclusion

Based on clinical evaluation and specular counts we concluded that the cell loss in present study was not statistically different in the phaco & SICS group. Surgically induced astigmatism was a significantly higher in SICS, the cause being longer length of incision in SICS. Thus both the phacoemulsification and the small-incision techniques are safe & effective for visual rehabilitation of cataract patients, although phacoemulsification gives better uncorrected visual acuity in a larger proportion of patients at 6months.

References

1. Vanaja Vaithianathan, Sivakumar should we shift temporally for phacoemulsification Journal of Tamil Nadu Ophthalmic Association vol 43b issue 3 september-2004.(82-86).
2. Dr. Vanaja Vaithianathan. Study of cataract surgeries in the initial and the last 500 of series of 2000 cases. Journal of Tamil Nadu Ophthalmic Association vol43c issue1 march 2005 (26-34).
3. Thomas Kohnen, MD, Paul m Mann, BA et al. Corneal topographic changes and induced astigmatism resulting from superior and scleral pocket incisions.
4. Dr. Madhavi Madhu, Dr. V. K. Raju- Kakinada, A study on post operative corneal astigmatism in superior and temporal sections of manual small incision cataract Jaffe Norman S., Claymen H.M. Pathophysiology of corneal astigmatism following Cataract extraction. Am. Acad. Ophthalmol., 79:615-30;1970.
5. Gogate PM, Kulkarni SR, Krishnaiah S, Deshpande RD, Joshi SA, Palimkar A, Deshpande MD Safety and Efficacy of Phacoemulsification Compared with Manual Small-Incision Cataract Surgery by a Randomized Controlled Clinical Trial: Six-Week Results, Ophthalmology, May 2005, (Vol. 112, Issue 5, Pages 869-874).
6. Dr. Navratan Dhanuka, Dr. A. Das, Dr. S. Pattanayak, Dr. B. S. Mishra, Dr. S. Dash, Dr. R. Dash, Dr. P. Biswal. JPM Rotary Eye Hospital & Research Institute, Cuttack Predictability of post-operative astigmatism in phacoemulsification with foldable IOL, phacoemulsification with rigid IOL and non-phaco small incision cataract surgery. AIOC proceedings 2004.
7. D.J. Pandey, N.A. Awasthi, N. Agnihotri, V. Mishra, B.D. Sharma, H.K. Biswa; Agra: Evaluation of Astigmatism in Small Incision Non Phaco Technique with Standard ECCE; Proceedings: All India Ophthalmological Society.
8. Dam-Johansen M., Olsen T. Refractive results after phacoemulsification and ECCE. A comparative study. Acta Ophthalmol (Copenh) 1993 Jun; 71(3):382-87.