

# Torsional Phacoemulsification versus Small Incision Cataract Surgery in Total Cataracts in the hilly region of Northern India

<sup>1</sup>Dr. Vatsala Vats, <sup>2</sup>Dr. Harshit Bhatt, <sup>3</sup>Dr. Tarannum Shakeel

<sup>1</sup>MS (Ophthalmology), Associate Professor (Ophthalmology) SGGRRIMHS. Dehradun

<sup>2</sup>MBBS, Junior Resident (Ophthalmology) SGGRRIMHS. Dehradun

<sup>3</sup>MS (Ophthalmology), Professor and Head (Ophthalmology) SGGRRIMHS. Dehradun

Corresponding Author

Dr. Vatsala Vats.

**Abstract: Background :** Total or 'NO GLOW' cataracts pose a surgical dilemma in terms of choice of surgery between SICS and Phacoemulsification.

**Aim :** This study compares the distribution of Torsional Phacoemulsification versus Small Incision Cataract Surgery in NO GLOW Cataracts : Settings and Design

A hospital based cross-sectional study, conducted in a tertiary care institute located in the hilly region of northern India.

**Methods and Material :** All patients above 40 years of age with NO GLOW cataract undergoing SICS/T-PHACO were included. Ethical approval and consent from patient was duly sought. The choice of surgery was based on the type of intraocular lens (IOL) afforded by the patient and anterior segment factors related to cornea and anterior chamber depth (ACD).

**Statistical Analysis :** The data was analyzed using SSPS trial version 23. For categorical data, Chi square test and student t test was applied.

**Results :** 251 eyes having cataract were operated out of which 71(28.3%) were NO GLOW cataracts. T-PHACO was done in 214 (85.3%) while SICS was performed in 37(14.7%) of total cases. The difference was found to be statistically significant. Out of the NO GLOW cataracts, just 35.2% eyes underwent SICS and 64.8% eyes had T-PHACO with a statistically significant difference. NO GLOW cataracts for SICS had mean axial lengths similar to those meant for T-PHACO with no significant difference. No eye undergoing T-PHACO had to be converted to SICS.

**Conclusion :** This study shows the plausibility of T-PHACO among patients and surgeons in eyes having total cataracts despite their smaller axial lengths.

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## Introduction

Total or 'NO GLOW' cataracts can be of various density depending on age, nuclear sclerosis, liquefied lens matter, and calcification. Hence, they pose a surgical dilemma in terms of choice of surgery and intraoperative events. The Torsional phacoemulsification (T-PHACO) is a scientific enhancement over linear technique, wherein T-PHACO exerts energy in an oscillatory fashion. Such an effect increases the efficiency by reducing the amount of ultrasonic energy and breaking the cataract by shearing effect and not by conventional jack hammer effect.<sup>1</sup> The modern cataract surgery aims to achieve a better unaided visual acuity with minimal surgery-related complications.<sup>2</sup> Small Incision Cataract Surgery (SICS) can be performed in almost all types of cataracts in contrast to phacoemulsification where case selection is extremely important for an average surgeon.<sup>3</sup> Moreover, SICS is economical, mitigates the suture-related complications of conventional extracapsular cataract extraction (ECCE) and in being manual, the ultrasound-related side effects such as those encountered in phacoemulsification are also avoided.<sup>4</sup> Thus SICS continues to hold relevance in the developing world. The advent of phacoemulsification has been associated with a progressive decrease in the size of the cataract incision to 3.0 mm or smaller with widespread use of foldable intraocular lens (IOL).<sup>5</sup> In the intra operative scenario, the smaller incision gives a more stable the anterior chamber with improved control during capsulorrhexis and hydrodissection.<sup>6</sup> T-PHACO has been considered a more effective and safe method for cataract removal than longitudinal traditional phacoemulsification.<sup>7,8</sup> T-PHACO is an interesting topic that warrants more studies as the machine is costlier than its linear counterpart and is not easily affordable by all health centers. Also hard cataract asserts its own issues of zonular weakness, calcified capsule, lack of epinuclear plate during trenching and chopping thus posing a considerable surgical challenge. This study aims to draw comparisons between SICS and T-PHACO and also explores the feasibility and popularity of both the surgical methods in the Himalayan region of northern India.

## Aim

This study compares the distribution of Torsional Phacoemulsification versus Small Incision Cataract Surgery in Total Cataracts in the hilly region of Northern India and assess the popularity of torsional phacoemulsification in total cataracts. It had the following objectives:

1. To record the eyes with cataract undergoing SICS and T-PHACO over a period of 12 months.
2. Any significant association of axial length with the T-PHACO.
3. To observe the duration of surgery.

**Material and Method** In this cross-sectional hospital based study, we included all patients above 40 years of age undergoing cataract surgery, after taking due permission from the Ethics Committee. A written and informed consent was also taken from all the patients undergoing cataract surgery. A NO GLOW cataract was defined as one with white pupillary reflex, total with 'NO GLOW' on fundus examination. Eyes with dislocated or subluxated lens, posterior segment pathologies like retinal detachment (RD), and previous ocular surgeries were excluded. The choice of surgery was based on the type of intraocular lens (IOL) afforded by the patient and anterior segment factors related to cornea and anterior chamber depth (ACD). After taking written and informed consent, proper history of the patient was elicited. Torch light examination in a dark room was done for visual acuity assessment in the form of perception of light (PL) and projection of rays (PR). Pupillary reaction was also noted to confirm the accuracy of PR. Detailed evaluation of eyes was performed using, slit lamp, gonioscopy and ocular sonography (USG A-Scan, USG B-Scan). In SICS, bridle suture was applied with 3-0 silk on superior rectus. Fornix based conjunctival flap is made and Number 15 blade was used to make a frown incision, two millimeters away from the limbus. A self sealing sclerocorneal tunnel was made with the help of crescent knife. A side port was made with 15 degree knife. Continuous Curvilinear Capsulorhexis (CCC) was performed with number 26 gauge needle capsulotome, after staining the dye with Trypan blue 0.06% (AUROBLUE). AC entry wound was enlarged with 5.2mm blade. Hydrodissection, and hydrodelineation, of the nucleus was done to free the nucleus from capsule and surrounding cortex. Nucleus was expressed out of anterior chamber with the help of viscoelastic device and bridle suture. Residual cortex was washed with Symcoe's irrigation and aspiration cannula. IOL was implanted in the bag. The viscoelastic was washed, side port was hydrated, and chamber was formed and maintained with self sealing tunnel.

Phacoemulsification (T-PHACO) was done by STOP and CHOP technique with the help of T-PHACO machine (CENTURION VISION SYSTEM-ALCON). Two side ports were made with 15 degree knife and capsulorhexis was performed after staining the capsule. Main port was made with 2.2 mm knife, with hydrodissection and delineation performed. Rotation of nucleus was checked. T-PHACO was performed and a foldable, unifocal IOL was implanted in the bag. Ports were sealed by hydration and eye was dressed with antibiotic drop.

### Statistical Analysis

The data was analyzed using SPSS trial version 23. All descriptive data was expressed as frequencies and percentages. For categorical data, Chi square test was used, and student t test was applied on numerical data to know the significance.

### Results

In the present study, 251 eyes having cataract were operated out of which 71 (28.3%) eyes had NO GLOW cataract. As per gender distribution, 128 (51%) were females, and 123 (49%) were males. The mean age of all the patients was  $59.42 \pm SD 9.22$  years.

#### Table 1: Age Group distribution with cataract

In the present study we found that there were more patients in the age group of 51 to 70 years. Similar pattern was also observed among NO GLOW cataracts.

#### Table 2: Gender distribution with NO GLOW Cataracts

Out of 71 NO GLOW cataracts, 44 (62.0%) were females, 27 (38.0%) were males. This difference was found to be statistically significant with a pValue of 0.029.

#### Table 3: Distribution with SICS/T-PHACO Surgery

T-PHACO was done in 214 (85.3%) eyes, while SICS was performed in 37 (14.7%) eyes. The difference was found to be statistically significant (pValue=0.00). Among females, 106 (82.8%) had T-PHACO while SICS was performed in just 22 (17.2%) females. Among males, 108 (87.8%) had T-PHACO, versus 15 (12.2%) who underwent SICS. There was no significant difference in access and use of either technique on the basis of gender.

#### Table 4: Gender distribution with SICS/T-PHACO in NO GLOW Cataracts

Of the 71 NO GLOW cataracts, just 25 (35.2%) patients underwent SICS and 46 (64.8%) patients opted for T-PHACO. Among 44 females, 27(61.4%) eyes had T-Phaco, while 17 (38.6%) had SICS. Among 27 males, 19 (70.4%) got T-Phaco whereas just 8 (29.6%) eyes underwent SICS.

#### Table 5: Surgery distribution in NO GLOW Cataract

No SICS was done among patients around 40 years of age. T-PHACO was done in 64.8% eyes and SICS was performed in 35.2% eyes. The difference was found to be statistically significant (pValue=0.014).

#### Table 6: Axial Length of NO GLOW cataracts versus Others

The mean axial length of NO GLOW cataracts was found to be  $22.90 \pm 0.69SD$  while that of the other 180 eyes was calculated as  $23.26 \pm 0.92SD$ . This difference was found to be statistically significant with a pValue=0.003.

#### Table 7: Mean Axial Length in T- PHACO vs SICS of NO GLOW Cataracts

NO GLOW cataracts for SICS had mean axial lengths similar to those meant for T-PHACO with no significant difference (pValue=0.77).

### Discussion

In the present study, we found that the mean age of patients undergoing T-PHACO, and SICS was nearly the same, and visual outcome was also similar with both the groups having uneventful procedures. A randomized study done in south India has reported excellent visual outcomes with low complication rates by both techniques.<sup>9</sup> Another randomized prospective study done in Nepal has reported that both phacoemulsification and SICS achieved excellent surgical outcomes.<sup>10</sup> It becomes imperative for us to state that the patients opted for SICS in view of the expenditure involved which was considerably less in SICS. Many studies have reported that SICS was significantly faster, less expensive and less technology dependent.<sup>9,10</sup>

The present study found that significantly higher number of females have presented with such advanced cataracts that could elicit NO GLOW on examination. This could be attributed to many factors like role in family, resources, transport, and geography of the Himalayan region. However, there was no significant difference in exposure to surgical technique on the basis of gender, implying both the genders were given an equal access to the two modes of surgery without any bias. Surgically, out of 214(100%) T-PHACO,

49.5% were performed on females, and 50.5% on males. So, our study could suggest that the choice of surgery was made on the basis of financial comfort. A meta-analysis comparing the two techniques by Gogate et al, has reported that the average time for SICS was lower and cost was less than half of phacoemulsification.<sup>11</sup> Since the present study involved T-PHACO, which incorporates costlier consumables, the difference in the expenses of both the surgical procedures can be easily assumed to be more. In the present study 85.3% of eyes underwent T-PHACO which was statistically significant. Among NO GLOW cataracts, T-PHACO was done in 64.8% eyes and SICS was performed in 35.2% eyes. This difference was found to be statistically significant. Notably, no conversion from T-PHACO to SICS was done. A study from Egypt has reported 20% rate of conversion of phacoemulsification due to the nature of hard brown cataract which made the nucleus management more difficult and risky.<sup>12</sup> Thomas R has quoted that relative risk of nucleus drop with phacoemulsification was more than in SICS. Even the most experienced surgeons, sometimes, even if it was because of the machine error, choose to convert to SICS, utilizing the same wound, for better outcomes.<sup>13</sup> Muhtaseb et al has reported that phacoemulsification in eyes with white cataract was associated with conversion to manual non phacoemulsification technique. The rate of intra operative complications was shown to be similar for all grades of surgeons, thereby eliminating the issue of surgeon's experience as a complicating factor.<sup>14</sup> The superior grade of technology and scientific advancement in torsional phacoemulsification has allayed those fears of tissue burns and encouraged the surgeons to complete the surgery.

The mean axial length of NO GLOW cataracts was found to be significantly smaller than the rest of the eyes having lesser dense cataract. Thus in the present study, T-PHACO could successfully be performed inspite of shorter axial lengths without conversion to SICS. Also, there was no significant difference between axial lengths of eyes having NO GLOW cataracts undergoing T-PHACO and SICS, reflecting the increased popularity of T-PHACO both among patients and surgeons. Chang et al in their study on a new phacoemulsification system that actively monitors and maintains intra operative pressures reported that such fluidics facilitate anterior chamber stability.<sup>15</sup> A study by Sharif-Kashani et al has reported that the Centurion system achieved less occlusion break surge when compared with Infiniti and WhiteStar Signature systems. Lower post occlusion surge along with rapid vacuum limit response may increase the safety of phacoemulsification during cataract surgery.<sup>16</sup> Kotb and Gamil in their study have found torsional safer, faster (less ultrasound time), and less energy consuming in all grades than the longitudinal phacoemulsification.<sup>17</sup> Berdahl et al have opined that with torsional mode, the size of incision reduced from 2.8mm to 2.2mm. This reduction in corneal incision was favourable to the endothelium and produced clinically significant decrease in endothelial cell loss.<sup>18</sup>

The current study concurs with others on duration of surgery which was more in T-PHACO than in SICS.<sup>9,10,11</sup> However, we did not compare the ultrasonic time with SICS. The present study focused on feasibility of T-PHACO on total cataracts with significantly smaller axial lengths than other cataracts. The study did not intend to compare speed of surgery or technique. Even though SICS is cheaper, the popularity of T-PHACO was found to be on the rise as patients showed interest in phacoemulsification. This could be attributed to the demand and willingness of the patient to spend.<sup>13</sup>

The limitation of the study was that it lacked comparison of ultrasonic energy and time on different grades of cataract as it did not consider speed as variable for study. Also, only 'Stop and Chop' technique was used and effect of other methods on surgical experience with total cataracts is yet to be explored.

### Conclusion

The current study realizes the relevance of torsional phacoemulsification in total 'NO GLOW' cataracts despite the high cost and longer learning curve. It appears encouraging for both the surgeon, and the eye. However, SICS is a unique and promising support to all cataract surgeons amidst the surge in phacoemulsification technology.

### Tables

**Table 1: Age Group distribution in Cataract**

			Cataract		Total
			Others	NO GLOW	
Age_Cat	1.00	Count	9	5	14
		% within Age_Cat	64.3%	35.7%	100.0%
		% within cataract	5.0%	7.0%	5.6%
2.00	2.00	Count	29	10	39
		% within Age_Cat	74.4%	25.6%	100.0%
		% within cataract	16.1%	14.1%	15.5%
3.00	3.00	Count	45	26	71
		% within Age_Cat	63.4%	36.6%	100.0%
		% within cataract	25.0%	36.6%	28.3%
4.00	4.00	Count	73	23	96
		% within Age_Cat	76.0%	24.0%	100.0%
		% within cataract	40.6%	32.4%	38.2%
5.00	5.00	Count	24	7	31
		% within Age_Cat	77.4%	22.6%	100.0%
		% within cataract	13.3%	9.9%	12.4%
Total	Total	Count	180	71	251
		% within Age_Cat	71.7%	28.3%	100.0%
		% within cataract	100.0%	100.0%	100.0%

**Chi-Square Tests NOT significant (pValue=0.363)****Table 2: Gender distribution with NO GLOW Cataracts**

			Cataract		Total
			Others	TOTAL	
GENDER	F	Count	84	44	128
		% within GENDER	65.6%	34.4%	100.0%
		% within cataract	46.7%	62.0%	51.0%
	M	Count	96	27	123
		% within GENDER	78.0%	22.0%	100.0%
		% within cataract	53.3%	38.0%	49.0%
Total	Count	180	71	251	
	% within GENDER	71.7%	28.3%	100.0%	
	% within cataract	100.0%	100.0%	100.0%	

**Chi-Square Tests Significant (pValue =0.029)****Table 3: Surgery distribution in All cataracts**

			SURGERY		Total
			T-PHACO	SICS	
Cataract	Others	Count	168	12	180
		% within cataract	93.3%	6.7%	100.0%
		% within SURGERY	78.5%	32.4%	71.7%
	NO GLOW	Count	46	25	71
		% within cataract	64.8%	35.2%	100.0%
		% within SURGERY	21.5%	67.6%	28.3%
Total	Count	214	37	251	
	% within cataract	85.3%	14.7%	100.0%	
	% within SURGERY	100.0%	100.0%	100.0%	

**Chi-Square Tests Significant (pValue=0.00)**

**Table 4: Gender distribution with SICS/T-PHACO in NO GLOW Cataracts**

			SURGERY		Total
			T-PHACO	SICS	
GENDER	F	Count	27	17	44
		% within GENDER	61.4%	38.6%	100.0%
		% within SURGERY	58.7%	68.0%	62.0%
	M	Count	19	8	27
		% within GENDER	70.4%	29.6%	100.0%
		% within SURGERY	41.3%	32.0%	38.0%
Total		Count	46	25	71
		% within GENDER	64.8%	35.2%	100.0%
		% within SURGERY	100.0%	100.0%	100.0%

**Chi-Square Tests NOT Significant (pValue=0.440)**

**Table 5: Surgery distribution in NO GLOW Cataract**

			SURGERY		Total
			T-PHACO	SICS	
Age_cat	1.00	Count	5	0	5
		% within Age_cat	100.0%	0.0%	100.0%
		% within SURGERY	10.9%	0.0%	7.0%
	2.00	Count	4	6	10
		% within Age_cat	40.0%	60.0%	100.0%
		% within SURGERY	8.7%	24.0%	14.1%
	3.00	Count	21	5	26
		% within Age_cat	80.8%	19.2%	100.0%
		% within SURGERY	45.7%	20.0%	36.6%
	4.00	Count	14	9	23
		% within Age_cat	60.9%	39.1%	100.0%
		% within SURGERY	30.4%	36.0%	32.4%
	5.00	Count	2	5	7
		% within Age_cat	28.6%	71.4%	100.0%
		% within SURGERY	4.3%	20.0%	9.9%
Total		Count	46	25	71
		% within Age_cat	64.8%	35.2%	100.0%
		% within SURGERY	100.0%	100.0%	100.0%

**Chi-Square Tests Significant (pValue = 0.014)**

**Table 6: Axial Length of NO GLOW cataracts vs Others**

Axial Length	N=251	Minimum	Maximum	Mean	SD
Others	180	20.56	26.01	23.26	0.92
NO GLOW Cataract	71	21.15	24.99	22.90	0.69

pValue=0.003

**Table 7: Mean Axial Length in T- PHACO vs SICS of NO GLOW Cataracts**

Technique	N	Mean AL	St. Dev
T-PHACO	46	22.92	0.728
SICS	25	22.87	0.628
Difference in means is not significant (P= 0.77)			

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