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Original Research Article

Comparing the number of attempts required for complete nuclear chop using calibrated and conventional phacotip

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ABSTRACT

Background: Phacoemulsification is a state of art technique with a steep learning curve the configuration of the phacotip affects the efficacy and execution of the nuclear chopping techniques. Inadequate penetration of phacotip may result in partial thickness nuclear cleavage with residual posterior plane and over enthusiastic penetration may result in posterior capsule rupture. This may be avoided if some estimate can be made preoperatively of the depth of penetration required to achieve full thickness crack.
Methods: A total of 60 eyes of 60 patients with age related cataract with grade 4.0 to 6.9 (LOCS III) fulfilling the inclusion and exclusion criteria were included in the study after written informed consent. They were divided into two groups A and B with 30 patients each randomly using envelope method and were operated using conventional and calibrated phacotips respectively and the number of attempts required to achieve complete nuclear chop was noted.
Results: In group A, vertical chop was safely and effectively done is 23 patients in just one attempt while it took 2 attempts in 6 patients and 3 attempts in 1 patient. In group B, it took just one attempt in 26 patients while 2 attempts were required in 4 patients. The two groups were comparable (p value 0.453) and was found to be statistically significant.
Conclusions: With the use of a calibrated phacotip, the surgeon already knows to what depth he has to penetrate the tip into the center of nucleus depending upon the grade of cataract which results in safe and effective chop in minimum attempts where as in the conventional phacotip, it is more of a blind process. Hence the calibrated phacotip has taken the guess work out of question.

Keywords: Calibrated phacotip, Lens opacity classification system III, Nuclear chop, Posterior capsule rupture

INTRODUCTION

The Phacotips act like chisel and straws that carve and aspirate lens material. Conventionally most phaco surgeons use sculpting to carry out the procedure using the divide and conquer technique. The vertical chopping technique which offer much better result though difficult, has a higher learning curve and need a high degree of expertise.[1,2] To carry out a safe and effective vertical chop, the phacotip is introduced first through the main incision in the direction of optic nerve and burried upto the centre of nucleus or beyond the centre of nucleus specially in hard cataracts during vertical chop.[3]

The nucleus is impaled and held in the aspiration mode. The chopper is introduced later and is brought vertically downwards in the substance of nucleus to reach the point anterior to the phacotip and then both instruments are moved opposite in vertical plane creating a shearing force so that the posterior nuclear plate is fractured completely along with central hard nuclear hump dividing the nucleus into two complete halves without tearing the

posterior capsule. This is considered a safe and effective vertical nuclear chop. Till now there was no objectivity to suggest as to how much phacodepth has to be achieved to obtain a safe and effective vertical chop. Though Lisa brothers, Moore RL and Mahatme (in wood cutter's chop) had advised to expose the phacotip from 1.5 mm to 2.0 mm, they didn't give any scientific basis for this.[4]

Malik P and Dewan T gave objectivity to this by doing preoperative assessment of the required phacodepth mathematically and then based on the actual phacodepth required during surgery, they suggested the following nomogram (Table 1).[5]

Table 1: Nomogram for phaco depth required for different grades of cataract.

LOCS III Grade	Depth required
Grade 0.1 to 3.9	2.4 mm
Grade 4.0 to 5.5	2.6 mm
Grade 5.5 to 6.9	2.8 mm

The phacotip was calibrated with the first groove at 1mm beyond the terminal point of the phacotip. There are two bands of 0.2 mm width, first at 2.2 mm to 2.4 mm away from the point of the tip and the second 2.6 mm to 2.8 mm from the point of the tip.

With a conventional phacotip, the depth upto which it is embedded in the nucleus cannot be predetermined. It is based on trial and error which comes with experience of the surgeon and the surgeon may or may not achieve the required depth. This may lead to longer nuclear cleavage time, increased number of attempts to chop, more endothelial damage and increased chances of posterior capsule rupture. This dilemma is averted with a calibrated phacotip. Correct depth is of paramount importance as the nucleus should be cleaved into two equal halves without shattering, collapsing or straining of the zonules. The correct depth assessment was assessed solely by experience as it varies with the type and morphology of the cataract

With conventional phacotip, this is particularly cumbersome. The calibrated phacotip being used in this study has been designed with the objective of taking the guess work out of question. In case the first attempt did not work, one more attempt was made safely. During this second attempt, the nucleus was rotated 180 degrees.

METHODS

The study was conducted at Department of Ophthalmology, Post Graduate Institute of Medical Education and Research (PGIMER), Dr Ram Manohar Lohia Hospital (RML), New Delhi. The study was conducted from 1st November 2014 to 31st March 2016. Cases were enrolled from 1st November 2014 to 30th November 2015. All the cases were operated within the 1st month of enrolment.

Sample size was 60 cases.

Inclusion criteria

- Recruitment was done from the list of patients of either sex awaiting cataract surgery in eye OPD of Dr R.M.L. Hospital, New Delhi who were diagnosed as grade 4.0 to grade 6.9 (LOCS III) of age related cataract after they signed a written informed consent form.

Exclusion criteria

- Subluxated or dislocated lens.
- Central leucomatous corneal opacity/scar/dystrophy preventing visualization of cataractous lens for grading and surgery.
- Posterior synechia.

Method of data collection

Previously diagnosed patients of cataract reporting to eye OPD were approached to participate in the study. Written informed consent was taken from all the patients. Preoperative assessment including detailed history taking, systemic workup and careful anterior and posterior segment examination using slit lamp biomicroscopy was done in all cases. Consecutive sampling of study subjects with age related cataract was done with LOCS III. grade 4.0 to 6.9. After accounting for exclusion criteria, a minimum of 30 patients of either sex in each group were analysed

Blinding

The surgeon could not be blinded due to logistical reasons. The observer who is noting the outcome variables was blinded to the type of phacotip used in cataract surgery

The surgeries were performed by a single surgeon within one month of recruitment of patient at PGIMER Dr. RML Hospital, New Delhi. All surgeries were performed using phacoemulsification machine (APPASAMY INTERFACE: MODEL NO -0080110). The ultrasound power was fixed at 40% at linear mode with vacuums at 300-350 mm of Hg.

The number of attempts to achieve a complete nuclear chop was noted intra operatively.

Post-operative evaluation

Standard post-operative care was provided to all patients.

Post-operatively all patients were given:

Tab Ciprofloxacin----------500 mg BD for five days

Tab Ranitidine----------150 mg BD for 5 days

Topically Moxifloxacin 0.5% + Prednisolone Acetate 1% Six times per day with gradual tapering was used for 4 weeks.

Variables

Predictor variables

Grade of cataract 4.0 to 6.9 (LOCS III)

Outcome variables

Number of attempts at chop

Statistical analysis

Categorical variables were presented in number and percentage (%) and continuous variables were presented as mean±SD and median. Normality of data was tested by Kolmogorov-Smirnov test. If the normality was rejected then non parametric test was used. Statistical tests were applied as follows-

- Quantitative variables were compared using unpaired t-test/Mann-Whitney Test (when the data sets were not normally distributed) between the two groups.
- Qualitative variables were correlated using Chi-Square test /Fisher's exact test.

A p value of <0.05 was considered statistically significant.

The data was entered in MS EXCEL spreadsheet and analysis was done using Statistical Package for Social Sciences (SPSS) version 21.0.

RESULTS

Here, 60 patients with senile cataract with grade 4.0 to 6.9 (LOCS III), fulfilling the inclusion and exclusion criteria were included in the study group after written informed consent. They were divided into two groups A (conventional phacotip) and B (calibrated phacotip), 30 patients each randomly (Table 2).

The age of patients ranged from 43-88 years. Mean ages of patients included in the two groups A and B were 66.67±10.01 years and 66.3±9.87 years. Both groups were comparable in terms of age (p=0.887) (Figure 1).

Table 2: Distribution of sample in two groups.

Phaco tip	Non calibrated	Calibrated
Group	A	B
Patients	30	30

Table 3: Number of males and females in study population.

Sex	Group		Total	p value
	Non calibrated	Calibrated		
Female	16 (53.33%)	12 (40.00%)	28 (46.67%)	0.301
Male	14 (46.67%)	18 (60.00%)	32 (53.33%)	
Total	30 (100.00%)	30 (100.00%)	60 (100.00%)	

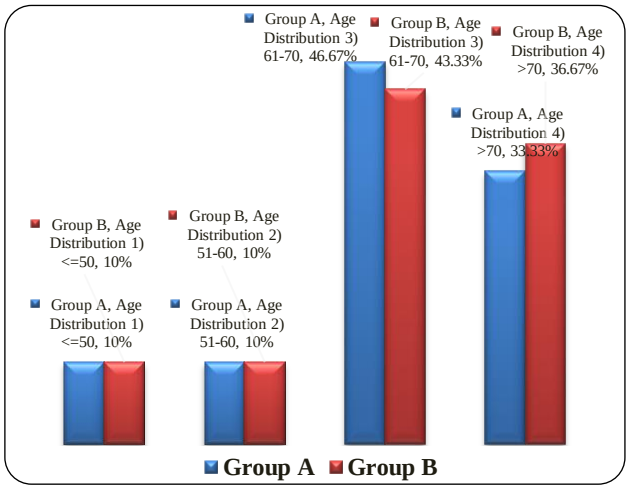

Figure 1: Age distribution in study subjects.

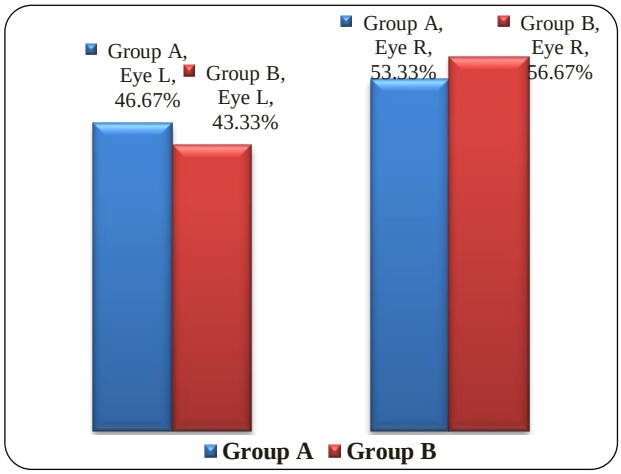

Figure 2: Eye wise distribution in study subjects.

Table 4: Number of attempts required for successful nuclear chop.

Attempts	Group		Total	p value
	Non calibrated	Calibrated		
1	23 (76.67%)	26 (86.67%)	49 (81.67%)	0.453
2	6 (20.00%)	4 (13.33%	10 (16.67%)	
3	1 (3.33%)	0 (0.00%)	1 (1.67%)	
Total	30 (100.00%)	30 (100.00%)	60 (100.00%)	

There were 28 females and 32 males in the study. There were 16 (53.33%) females and 14 (46.67%) males in group A and 12(40.00%) females and 18 (60.00%) males in group B. Both groups were comparable in terms of sex distribution (p=0.301) (Table 3).

There were 60 eyes in total. Out of which were 27 left eyes and 33 were right eyes. Of these 14 left and 16 right eyes were included in the Group A and 13 left and 17 right eyes were present in the Group B. Both groups were comparable in terms of eyes (p=0.795) (Figure 2). A total of 60 eyes of 60 patients, 30 in each group, having age related cataract with grade 4.0 to 6.9 as per LOCS III were included in this study.

The two groups were comparable (p value=0.995) (Figure 3). The mean number of attempts at each successful chop in group A was 1.27±0.52 while in group B was 1.13±0.35. The two groups were comparable (p value=0.453) (Table 4).

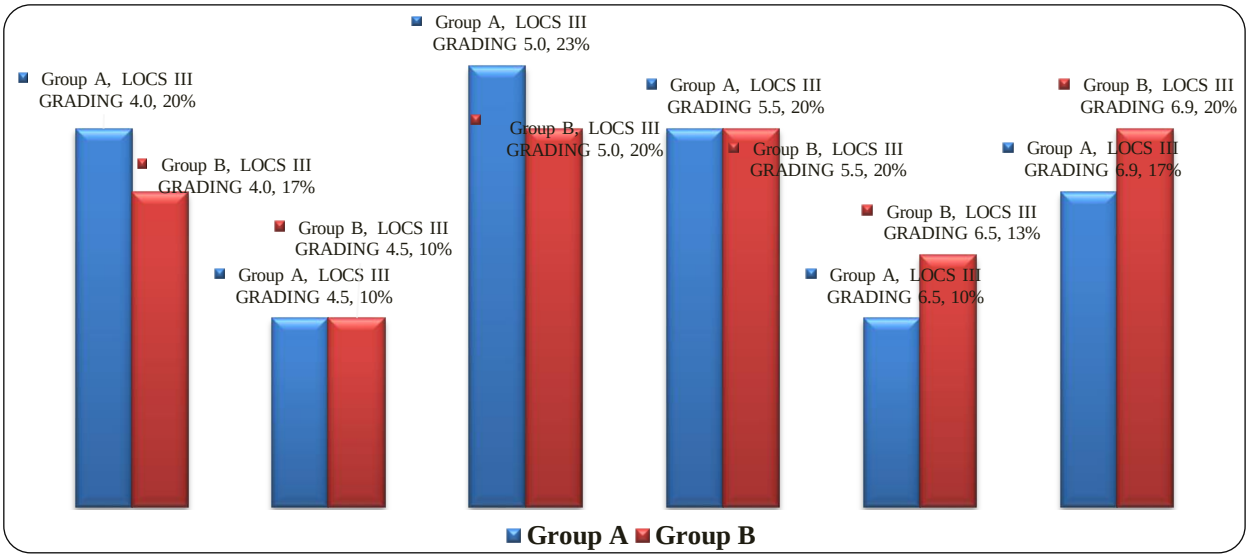

Figure 3: Distribution of grades of cataract in study population as per LOCS III.

DISCUSSION

A prospective randomized study to compare the number of attempts for complete nuclear chop using a calibrated and conventional phacotips during coaxial micro incisional cataract surgery, was conducted at the Department of Ophthalmology, PGIMER Dr Ram Manohar Lohia Hospital, New Delhi.

Patients awaiting cataract surgery for age related cataracts of grade 4.0 to 6.9 according to Lens Opacities Classification System III (LOCS III) reporting to eye OPD at Dr. RML Hospital, were approached to participate in the study. Written informed consent was taken from all the patients. Preoperative assessment including detailed history taking, systemic workup and careful slit lamp bio microscopy was done.

A total number of 60 subjects fulfilling the inclusion and exclusion criteria were randomized to one of the study group after written informed consent. Those allocated to group A underwent phacoemulsification using a non-calibrated phacotip and those allocated to group B underwent phacoemulsification using a calibrated phacotip. The results obtained were studied in the light of available literature.

Table 1 shows the nomogram for the phaco depth required for successful phaco chop for various grades of cataract. Table 2 shows the division of the study population into two groups.

As shown in Figure 1, the age of patients ranged from 43-88 years. Mean ages of patients included in the two groups A and B were 66.6±10.01 years and 66.3±9.87 years respectively. Both groups were comparable in terms of age (p=0.887). As shown in Table 3, there were 28 females and 32 males in the study. There were 16 (53.33%) females and 14 (46.67%) males in group A and 12 (40.00%) females and 18(60.00%) males in group B. Both groups were comparable in terms of sex distribution (p=0.301).

As shown in Figure 2, there were 60 eyes in total out of which there were 27 left eyes and 33 right eyes. Of these 14 left and 16 right eyes were included in the Group A and 13 left and 17 right eyes were present in the Group B. Both groups were comparable in terms of eyes (p=0.795).

As shown in Figure 3, 60 eyes of 60 patients with age related cataract were included in the study and graded between 4.0 to 6.9 as per LOCS III grading. 30 patients in each group were graded. Both the groups were comparable in terms of grading of cataract as per LOCS III (p=0.995). As shown in Table 4 in group A, vertical chop was safely and effectively done is 23 patients in just one attempt while it took 2 attempts in 6 patients and 3 attempts in 1 patient. In group B, it took just one attempt in 26 patients while 2 attempts were required in 4 patients. The two groups were comparable (p value 0.453).

With the use of a calibrated phacotip, the surgeon already know to what depth he has to penetrate the tip into the center of nucleus depending upon the grade of cataract which results in safe and effective chop in minimum attempts where as in the conventional phacotip, it was more of a blind process. Hence the calibrated phacotip has taken the guess work out of question. Mahatme V, in wood cutter chop technique had advised to expose the tip from 1.5 mm to 2.0 mm but he failed to give any scientific basis for it.[6]

The nuclear disassembly requires various nuclear fragmentation techniques and configuration of phacotips affects the efficacy and execution of nuclear chopping techniques.[7-10] In conventional phacotip, this is more of a blind, subjective procedure and proprioceptive feeling which comes with experience of the surgeon. The learning curve for phacoemulsification is generally accepted to be quite steep.[11,12] This calibrated phacotip can be a boon for the trainees There have been no studies done yet to see a correlation between time required to produce a nuclear cleavage with different types of phacotips.

CONCLUSION

A total of 60 eyes of 60 patients with cataract were taken and were preoperatively assessed and graded according to LOCS III grading. All the patients underwent coaxial phacoemulsification. Patients were randomly divided into two groups A and B. Group A and Group B underwent phacoemulsification using a non-calibrated and calibrated phacotips respectively and the number of attempts required to cleave the nucleus into two halves completely and safely was noted and compared. From this study, authors found out that the number of attempts taken to cleave the nucleus into two halves was less with a calibrated phacotip than with the conventional phacotips. This was largely because the surgeon knew as to what depth he has to penetrate the phacotip in the center of nucleus depending on the grade of the cataract

This lead to a significant reduction in the total surgical time which can be beneficial for the patient in terms of less endothelial cell loss and less intraop complications. However no such study has been done to compare the chop attempts with various types of phacotips, hence further work needs to be done on this subject.

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Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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