CHICK FEED TECHNIQUE VERSUS STANDARD CHOP TECHNIQUE IN MICRO INCISION CATARACT SURGERY

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Background: The important factor for improving the cataract surgery is reduction in size of corneal incision. Small incision results in less induced astigmatism, and faster visual rehabilitation. **Methods:** An analysis of 100 eyes of 80 patients operated for phacoemulsification through micro incision by standard chop technique (50 eyes) in group-I, and chick feed technique (50 eyes) in group-II is presented. All of the patients were operated on by posterior limbal corneal incision under topical or sub-tenon anesthesia. In all patients, posterior chamber bag fixation foldable intraocular lens implantation was performed through 1.4 to 1.6 mm corneal incision. **Results:** Forty patients (80%) out of fifty operated in group-2 had an over all visual recovery of 6/12 to 6/9 on day one post operative, as compared to group-1 where only ten (20%) patients out of fifty had visual recovery of 6/12 to 6/9. In the second week, out of 37 patients operated in group-2, thirty patients (81%) had visual acuity 6/6. Similarly in second week post operative, out of forty three patients operated in group-1, only eighteen patients (41.8%) had V/A of 6/6. Maximum visual recovery was observed in early post operative phase in group-2 patients. **Conclusion:** The chick feed technique has been proved to be the most compromising method in micro incision cataract surgery, as compared to standard chop method, due to its capability of working on low energy and negligible vacuum.
Keywords: Cataract; Phaco MICS; Chick Feed Technique; Standard Chop Technique

INTRODUCTION

The evolution of techniques in cataract surgery has been associated with a progressive decrease in the size of cataract incision. The size of wound has been decreasing from 12 mm (intra capsular cataract surgery), 9–10 mm (extra capsular cataract surgery), and 3.2 mm with the advent of Phacoemulsification, with foldable intraocular lens (IOL) implantation. Further reduction in the size of clear corneal wound, i.e., 1.2 mm and 0.9 mm, has been made possible with the technique of bimanual/micro incision Phacoemulsification.

Phacoemulsification is an extra capsular cataract extraction technique performed through a small incision. The first Phacoemulsification surgery was performed in 1967 by Dr. Charles Kelman.[1] In 1970, Dr. Girard attempted to separate infusion source from ultrasound and aspiration.[2,3] In 1985, Dr. Shearing and his colleagues performed ultrasound phaco through two 1mm incisions using an anterior chamber maintainer and a phaco tip without irrigation sleeve.[4] On August 15, 1998, Agarwal and his colleagues developed a bimanual technique, 'Phaco Nit', by standard phaco chop technique. They used an irrigation chopper and a bare phaco needle which was passed through a 0.9 mm clear corneal incision.[5,6] Agarwal *et al* achieved adequate temperature control through continuous infusion and use of cooled balanced salt solution poured over the phaco needle continuously during the procedure.[7] In 2000, Tsuneoka, Shiba, and Takahashi[8] performed bimanual Phaco-emulsification through karate chop technique using a 1.4 mm (19-guage) incision and a 20-guage sleeveless ultrasound tip.

Randall Olson (MD, Salt Lake City)[9,10] first used a 0.8 mm phaco needle and a 21-gauge irrigating chopper and called it micro phaco . Dr. Tsuneoka[11] implanted an intraocular lens with a modified injector through a 2.2 mm incision. Jorge Alio (Spain)[12] used the term MICS or micro incision cataract surgery for all surgeries including laser cataract surgery and Phaco Nit.

Micro incision cataract surgery (Phaco MICS) by Chick Feed technique a recently introduced method can be applied on dense cataract using minimum vacuum and negligible Phaco power. Fragmentation and emulsification can be performed using phaco flip method at supra capsular level without affecting corneal endothelium. There is no need of pouring cooled solution over the sleeve less Phaco tip, as negligible ultra sound energy is utilized.

MATERIAL AND METHODS

This comparative study was conducted at Liaquat University eye hospital Hyderabad from June, 2004 to November, 2005. One hundred eyes of 80 patients were operated on by Phacoemulsification using the standard chop technique (Group-1), and chick feed technique (Group-2).

Inclusion Criteria: Patients with better understanding, lenticular density of grade II and III, normal healthy cornea, less than 5D of hyperopia or myopia, less than 1.5D of with rule or against rule astigmatism, having been controlled for diabetes and hypertension, or with no cardiovascular problems, were selected.

Exclusion Criteria: Patients with pre-existing glaucoma, uveitis, pseudo exfoliation

syndrome, corneal disease or those with the pupil responding poorly to mydriatics.

As a part of pre operative assessment, ocular slit lamp bio microscopy, applanation tonometry and dilated ophthalmoscopy with 90 D or 78 D bi-Spheric lenses was performed. Nucleus hardness was graded from plus II to III on slit lamp biomicroscopy.

The necessary routine investigations like complete blood count (Blood CP), Blood Glucose, Urine detailed report, and X-Ray chest (if needed) were carried out. Ofloxacin 0.3% topical drops were instilled 2 hourly 24 Hrs before surgery. Complete Pupillary dilatation was achieved using tropicamide 1% ophthalmic drops and if required phenylepherine 10% ophthalmic drops. Topical non steroidal anti-inflammatory drops were used every 15 minutes one hour before surgery to maintain Pupil dilatation during surgery.

Patients were operated on under topical anaesthesia using xylocaine 4% eye drops (forty two eyes in chick feed technique and thirty seven eyes in standard chop technique), and sub tenon anaesthesia with 2cc of 1:1 mixture of Inj. Xylocaine 2% and Inj. Abocaine (bupivacaine 0.5%), by blind dissection at lateral one third of lower conjunctiva (eight eyes in chick feed technique and thirteen eyes in standard chop technique). All of the 100 cases were operated on for cataract extraction by Phacoemulsification through micro incision using standard chop technique (50 cases), and chick feed technique (50 cases), with standard 1mm bare Phaco tip without sleeve. Posterior chamber bag fixated Intraocular Lens (IOL) implantation was performed in all hundred eyes. The foldable intraocular lenses used were Hydrophillic Accrylate (Plate haptic) lenses.

Techniques:

1- The Chick Feed Technique:

One millimeter (1 mm) incomplete partial thickness posterior limbal corneal valve incisions were created with a diamond micro incision knife, between superior rectus and lateral rectus muscle (Upper temporal incision), and between superior rectus and medical rectus muscle (Upper nasal incision) at equal distance. Under hydroxy propyl methyl cellulose 2%, 5–6 mm closed chamber round anterior capsulotomy was performed through upper temporal partial thickness corneal incision in right eye and upper nasal corneal incision in left eye, with 27 gauge BD needle used as cystotome tip.

In the presence of visco solution, the anterior chamber was entered with 1.4 mm micro incision knife. Hydro dissection was performed using both incisions by injecting balanced salt solution/ringer solution, underneath anterior peripheral capsular rim, until a fluid wave was seen passing behind the lens nucleus. Hydro delineation was completed, by injecting ringer solution anteriorly between lens nucleus and cortex to mobilize lens nucleus. Care was taken to use less amount of fluid due to small size of corneal incisions avoiding pressure damage to posterior capsule and lens zonules. In the presence of Viscoelastic solution, with the cystotome tip, the nucleus was moved clock and anti clock direction to ensure free in the bag nucleus rotation.

Phacoemulsification was performed with Universal-II Phacoemulsification systems. Only one surgeon operated all of the cases included in this study. A 20–21-gauge irrigating chopper (Micro Surgical Technology by Duet USA) was inserted through the side port. That instrument was connected to the infusion line of Phaco machine. The 15° sleeveless Phaco tip, connected to aspiration line, was inserted through second corneal incision, and Phacoemulsification performed through chick feed technique as follows:

Phaco tip was engaged deep in the centre of nucleus on vacuum mode. The engaged nucleus was flipped at supra capsular level, and divided from outer edge towards the centre by the help of irrigating chopper to 6 to 8 slices by anti clock wise continuous nucleus rotation all around 360º.

Each slice was taken one by one, engaged at the Phaco tip on vacuum mode, crunched in to multiple smaller pieces, with irrigating chopper and fed to Phaco tip, just like mother Hen feeds her chick. All of the nucleus fragments were removed on vacuum mode. Linear Phaco energy on pulse mode was used only to bulk engaged nucleus fragments. Epinucleus was removed on vacuum mode. The cortical cleanup along with posterior capsule polishing was performed with bimanual irrigation and aspiration (I/A) system supplied by Duet USA. There was no need of pouring the balanced salt solution over the bare Phaco tip at corneal incision, because of negligible use of Phaco power, and less chances of corneal wound burn (fish mouthing).

In the presence of Visco solution, posterior chamber bag fixated foldable intraocular lens (IOL) implantation with injector, was performed through 1.4 mm to 1.6 mm corneal incision. The visco gel was removed by irrigating solution, and the wound left unstitched. The eye was left un-patched and patient was advised to use prescribed ophthalmic drops with every one hour interval.

2- Standard Chop Technique:

The procedure and steps of standard chop technique were exactly the same as in chick feed method. The main difference in these two techniques is that in standard chop method, the nucleus was divided in four equal parts by cross trench method and each fragment was taken individually, chopped and removed through Phaco tip. The nucleus fragments were not crunched as

we did in the chick feed method. The Phaco power and vacuum were increased to remove bigger nuclear fragments. In this technique we used to keep on rinsing the bare Phaco tip with ringer solution with 20 cc syringe to avoid corneal wound burn (fish mouthing) due to higher ultra sound energy. Rest of the steps were carried out similar to the chick feed technique.

RESULTS

Out of one hundred (100) eyes operated for phaco MICS followed by foldable IOL implantation, 50 eyes were operated by chick feed technique, and 50 eyes by standard chop technique. Only 80 eyes (80%) completed the post operative follow up criteria of this study.

Out of 100 eyes, forty five had nuclear cataract, thirty five had cortical cataract shown in Figure-1 and 4 respectively. The remaining twenty eyes had posterior sub capsular cataract (Table-1).

In 65 (65%) eyes, the nucleus density was graded as Plus II and 35 (35%) had nucleus grading of Plus III (Table-2). Table-3 shows the different Phaco-emulsification parameters used in chick feed technique and standard chop technique.

All of the patients were equally distributed according to their nucleus density and divided in to two groups to be operated upon standard chop technique and chick feed technique, mentioned in Table-4.

Forty patients (80%) out of fifty operated in group-2 had an over all visual recovery of 6/12 to 6/9 on day one post operative shown in Figure-2 and 3, as compared to the standard chop method (group-1) (Figure-5, 6), where only ten (20%) patients out of fifty had visual recovery of 6/12 to 6/9 (Table-5).

Forty three eyes operated in group-1 and thirty seven out of fifty operated in group-2 completed the post operative follow up. In the second week, out of 37 patients operated in group-2, 30 patients (81%) had visual acuity (V/A) 6/9 to 6/6. Five patients (13.5%) had V/A 6/12 to 6/9 at 4th week post operative. Only 2 patients (5.4%) had V/A 6/18 to 6/12 with induced astigmatism 1.5 D at 8th week post operative (Table-6).

Similarly in second week post operative, out of 43 patients completing the follow up and operated in group-1, only 18 patients (41.8%) had V/A 6/9 to 6/6, 12 patients (27.9%) had V/A 6/12 to 6/9 at 4th week and 13 patients (30.2%) had V/A 6/24 to 6/12 on 8th week post-operative (Table-6).

During surgery, 7 (14.0%) eyes operated in group-1 developed corneal wound fish mouthing due to increased Phaco power in without sleeve Phaco tip, while non in group-2 developed fish mouthing. Three (06.0%) eyes had an iris prolapse through side port and 9 (18.0%) eyes showed pupil constriction during operation in group-1. While only 6 (12.0%) eyes developed pupil constriction during surgery in group-2 (Table-7). Micro cystic corneal oedema was noted in 9 (18%) eyes operated in group-1, and in group-2, only 3 (6%) eyes developed corneal oedema on first post-operative day. Similarly in group-1, 11 (22%) eyes developed striate keratopathy, while only 5 (10%) eyes developed striate keratopathy in group-II. In group-I, anterior chamber cellular reaction was observed in 3 (6%) eyes, while only 1 (2%) eye developed cellular reaction in group-II. In late phase, after two weeks of surgery, 2 (2.5%) eyes developed segmental iris discoloration in group-2 (Table-7).

Table-1: Type of Cataract: (n=100)

Type	Number	Percentage
Nuclear	45	45%
Cortical	35	35%
Posterior Sub Capsular	20	20%

Table-2: Nucleus Grading With Preoperative Visual Acuity (Total Eyes=100)

Nucleus Grading	N/O Eyes	Pre-Op V/A
II	65 (65%)	6/36 – 6/24 Overall
III	35 (35%)	6/60 – FC Overall

Table-3: Phacoemulsification Parameters in Chick Feed and Chop Technique (n=100)

Mode: Pulse mode. **Bottle Height:** 80 to 100 cm above patient's head

Machine Setting	Technique	Nucleus G-II 15 Degree Tip			Nucleus G-III 15 Degree Tip		
		A	B	C	A	B	C
Vacuum mmHg	Standard Chop	40	60	90	40	80	100
	Chick Feed	20	40	40	40	60	60
Aspiration cc/min	Standard Chop	22	26	26	24	26	26
	Chick Feed	22	22	22	24	24	24
Phaco Power (%)	Standard Chop	Upper limit 60			Upper limit 70		
	Chick Feed	Upper limit 30			Upper limit 40		
Total Phaco Time	Standard Chop	Overall 30 sec			Overall 45 sec		
	Chick Feed	Overall 10 sec			Over all 20 sec		

A = Sculpt B = Nucleus Chop C = Epinucleus. G= Grade

Table-4: Patients operated by Chick feed and Chop technique (n=100)

N/O Eyes	Nucleus Grading	Technique	Total Eyes
33	II	Standard Chop	
17	III	Standard Chop (Group-I)	50
33	II	Chick Feed	
17	III	Chick Feed (Group-II)	50

Table-5: Visual Acuity of operated eyes: (day one post operative)

Eyes	V/A (uncorrected)	Technique	Total Eyes
40	6/12–6/9	Chick Feed	
10	6/24–6/18	Chick Feed	50
10	6/12–6/9	Standard Chop	
28	6/18–6/12	Standard Chop	
12	6/36–6/24	Standard Chop	50

V/A = Visual Acuity.

Table-6: Postoperative Visual Rehabilitation: (n= 80)

Eyes	Visual Acuity	Astigmatism	Follow up	Technique
30	6/9–6/6	0.5 D	2nd week	Chick Feed
05	6/12–6/9	Up to 1.0 D	4th week	= = = = =
02	6/18–6/12	1.5 D	8th week	= = = = =
18	6/9–6/6	0.5 D	2nd week	Standard Chop
12	6/12–6/9	Up to 1.0 D	4th week	= = = = =
13	6/24–6/12	1.5 D	8th week	= = = = =

Table-7: Operative and Post Operative Complications

Complication	Standard Chop Technique Group-I (n=50)	Chick Feed Technique Group-II (n=50)
A: Operative Complications		
Fish Mouthing	7 (14.0%)	Nil
Iris Prolapse	3 (06.0%)	Nil
Pupil Constriction	9 (18.0%)	6 (12.0%)
B: Early Post Operative Complications		
Micro Cystic Corneal Oedema	9 (18.0%)	3 (6.0%)
Striate Keratopathy	11 (22.0%)	5 (10.0%)
Anterior Chamber Cellular Reaction	3 (06.0%)	1 (2.0%)
C: Late Post Operative Complications		
Segmental Iris Discoloration	Nil	2 (2.5%)

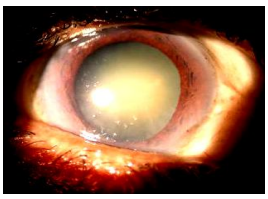

Figure-1: A 55 year old lady with left eye senile nuclear cataract admitted for left phaco MICS through Chick Feed Technique.

Figure-2: First post-operative day of a lady operated for left eye MIC and IOL implantation through Chick Feed technique. There is air in anterior chamber. Visual acuity was 6/18 un-aided.

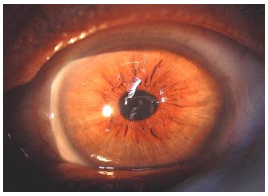

Figure-3: Third post operative day operated for left eye Phaco MICS through Chick feed technique. Air in anterior chamber is dissolved. Visual acuity was 6/9 un-aided.

Figure-4: A 61 years male with senile cortical cataract was admitted for Right Phaco MICS through Standard Chop Technique.

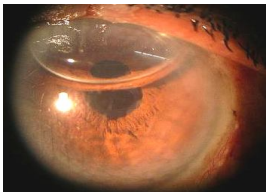

Figure-5: First Post Operative day of a 61 years male operated for right eye Phaco MICS through standard chop technique. There was air in anterior chamber. The visual acuity was 6/36 un-aided.

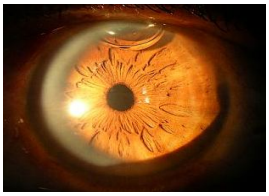

Figure-6: Third post operative day of a 61 years male operated for right eye Phaco MICS through standard chop technique. The air in anterior chamber is nearly absorbed. The visual acuity was 6/9 un-aided.

DISCUSSION

A smaller incision in cataract surgery results in less induced astigmatism, faster visual rehabilitation, and improved wound security.[13,14] Micro incision cataract surgery (Phaco MICS) ensures improved chamber stability during surgery, better follow ability due to physical separation of infusion from ultrasound and vacuum. Smaller wounds heal more rapidly with less risk of leakage. Visco elastics do not leave the eye through small incisions.[15] The greatest advantage of bimanual technique lies in its ability to remove sub incisional cortex without difficulty. By using the infusion and aspiration sources separately through two micro incisions, sub incisional cortical clean-up can be performed quickly and safely.[16]

Standard phaco chop and fracture technique is also effective in increased Phaco time producing less effect to corneal endothelium.[17] But according to our observation, in hard cataracts (grade-III), the vertical or horizontal Phaco chop technique affects corneal endothelium. The chick feed technique on the other hand applied on hard cataracts; cornea is usually less affected, due to negligible Phaco energy, and visual recovery is rapid in early post operative phase. In our study better results were obtained using chicks feed method.

Using the chick feed technique bimanual Phaco surgery ensures reduction in time of phaco power, thus avoiding many untoward ocular effects while working on increased ultrasonic power.

In the technique of high vacuum phaco extraction, less ultra sonic energy is consumed.[17,18] But in our experience, high vacuum can some times cause sudden collapse of anterior chamber, causing posterior capsule tear and corneal endothelial

damage. Such a complication was not encountered in chick feed technique, which works on extreme low vacuum and power.

During bi-manual Phacoemulsification, 1.4 mm incision versus 1.0 mm sleeveless Phaco tip is used to facilitate out flow around the tip through the incision to provide adequate cooling effect and less chances of corneal wound burn.[19] In this study, we also used 1.4 mm corneal incision in all of the 100 eyes of eighty patients.

The supra capsular technique of Phacoemulsification, i.e., Phaco flip technique is also effective in preventing posterior capsular tear and traction on the zonules.[20] In our experience, the Phaco flip technique in standard chop and fracture method, affects corneal endothelium in hard cataracts, due to ultrasonic thermal effect. Such a situation does not develop in chick feed technique if applied at supra capsular level, due to its capability of working on extremely low vacuum and negligible Phaco power.

Utilizing Phaco power on pulse mode, interrupted release of Phaco energy ensures safety of corneal endothelium, and other intraocular structures. In this study, Phaco power on pulse mode was used in all of one hundred eyes.

During micro incision cataract surgery, iris prolapse through the side port occurs due to increased flow rate in standard chop technique. In chick feed technique there is no need of increasing the flow rate as it works on extremely low vacuum and power.

In chick feed technique, negligible Phaco energy is utilized, therefore there is no need of pouring cooled water on bare Phaco tip to avoid corneal wound burn during the procedure. Late onset segmental iris discoloration develops due to manipulation with the sleeve less tip and chopper during surgery. In our study, two patients developed late iris discoloration using chick feed technique.

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