

Corneal Clarity after Phacoemulsification: Nuclear Management by Stop and Chop Method

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Abstract

Introduction: Restoration of effective vision is the principal aim of all modalities of cataract surgery including phacoemulsification. In this method, nuclear part of the cataractous lens is emulsified by ultrasonic power. Energy level of ultrasonic power and turbulence of fluid in the anterior chamber play an important role in corneal endothelial cell loss which in turn influences post-operative corneal clarity. Endothelial cell loss can be minimized by modification of nuclear management method. The common nuclear division techniques of phacoemulsification are stop and chop, divide and conquer and phaco chop. **Purpose:** To show post-operative corneal clarity after phacoemulsification by stop and chop technique of nuclear divisions. **Materials and Methods:** This prospective observational study was conducted at selected outdoor patients from January, 2023 to June, 2023 over 33 patients of age related cataract selected for phacoemulsification surgery. Patients were selected based on specific selection criteria. Selected patient underwent detail, ocular and systemic examinations as well as relevant investigations which included assessment of corneal endothelial cell count and central corneal thickness. Phacoemulsification were done in all patients by a single expert surgeon where technique of nuclear management by stop and chop were chosen randomly. Patients were followed up on 1 week, 4 week and 12 week after surgery. Corneal endothelial cell count and central corneal thickness were assessed in each visit. All the relevant data were presented by appropriate tables. **Results:** The mean age of the study subjects were 60.96 with standard deviation 1.75 years out of which 14 were males and 17 were females. Pre-operative value of mean endothelial cell count was $2620 \pm 70.20/\text{mm}^2$. Mean value of endothelial count was $2420 \pm 68.90/\text{mm}^2$, $2345 \pm 66.64/\text{mm}^2$, $2310 \pm 66.04/\text{mm}^2$ respectively after 1 week, 4 weeks and 12 weeks after surgery. Mean value of central corneal thickness was 545 ± 40.50 micrometer, 535 ± 40.02 micrometer, 532 ± 39.85 micrometer respectively after 1 week, 4 weeks and 12 weeks after surgery. **Conclusion:** Quantitative assessment of endothelial cell count and central corneal thickness shows that at end of the study there was no significant difference in mean endothelial cell count and mean central corneal thickness.

Keywords: Corneal clarity, phacoemulsification, stop and chop.

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Introduction:

In phacoemulsification nucleus is ultrasonically divided and aspirated through an incision which is less than 3 mm in diameter^{1,2}. Phacoemulsification is gradually adopted by a wide range of surgeons and its acceptance is increasing day by day. It is now a procedure of choice for about 50% of surgeon by 1999, 79% of surgeons by 1992³ and is almost universal nowadays. Many procedures have been described for the management of lens nucleus. They are of 2 broad categories. Sculpting techniques in which phacoemulsification is done by sculpting the nucleus in order to decrease its size and to create trenches along which nucleus may be divided. The pieces of divided nucleus are then made into small pieces and emulsified⁵. In chopping techniques, a chopper i.e. 2nd instrument is introduced and drawn across the nucleus to make the nucleus into smaller fragments. These smaller fragments can be separated by main mass of the nucleus and emulsified^{6,7}. In stop and chop technique, described by Dr. Paul Koch⁸, a central trench is first sculpted and the nucleus is divided into 2 halves or 2 hemi nuclei. The surgeon next 'stops' sculpting and commences 'chopping'. This method is a variation of the Nagahara chop that provides space within the capsular bag for nuclear handling as well as helps in removal of first nuclear piece.

After division of the nucleus, the fractured nucleus is rotated through 90 degree, engaging the phacotip into the heminuclei using short burst of ultrasound and increasing vacuum gripped heminuclei is drawn centrally. The chopper is drawn toward the phacotip after passing out to the lens periphery and separating the two instruments liberates fragment from the theheminuclei which is emulsified easily. This process is repeatedly done until the first heminuclei is totally gone and the remaining part of the nucleus is removed in a same manner. There are few reports available on loss of endothelial cell count in different nuclear disassembly techniques with ambiguous result. Therefore, we conducted these studies in 33 patients subjecting them to nuclear managements by stop and chop and the rate of corneal endothelial cell loss and central corneal thickness were assessed.

Materials and Methods:

This prospective observational study was conducted at selected outdoor patients from January, 2023 to June, 2023 over 33 patients of age related cataract selected for phacoemulsification surgery. An analysis was done in 33 patients undergoing phacoemulsification at Shaheed Mansur Ali Medical College, Uttara and Mirpur Eye Hospital, Mirpur on corneal endothelial cell loss and central corneal thickness. These 33 patients were randomly selected who were operated by a single surgeon. In these study, operation was on these patients by stop and chop technique. Patients were selected based on some inclusion criterias like nuclear grade 1-3, healthy cornea, full pupil dilatation, good red reflex, easy surgical access, average axial length (22-25), lack of other ocular comorbidities. Brown and black cataract, preoperative endothelial count less than 1000 per sq.mm were excluded from this study. Each patient underwent preoperative evaluation including best corrected visual acuity (BCVA), details slit lamp examination, nuclear sclerosis grading, funduscopy, intraocular pressure (IOP) by Goldman applanation tonometry (GAT) and regurgitation test to check the patency of nasolacrimal duct. Using TOPCON SP 3000P specular microscope specular microscopy was done preoperatively in each patient and corneal endothelial cell count and corneal thickness was recorded. After getting written informed consent patient underwent phacoemulsification by this technique under peribulbar anaesthesia. All patients were followed up on post-operative day, 1 week, 4th week and 12th weeks. On every visit, best corrected visual acuity (BCVA) was tested and complete slit lamp examination was done. Specular microscopy was done to determine the endothelial cell count and central corneal thickness (CCT) at 1st, 4th and 12th weeks of follow-up. At the end of these study, the data was compiled and tabulated.

Results:

The mean age group of patient was 60.96 with standard deviation 1.75 years. Out of 33 patients, 14 were male and 17 were female patients. Most common type was nuclear cataract followed by posterior sub capsular cataract. Regarding the corneal thickness, both groups showed a significant increase in

corneal thickness. A maximum increase in corneal thickness was reached at first POD and decreased gradually to reach the preoperative value by 3rd month. A decrease in endothelial cell count 11.58% in stop and chop method were recorded at 12th week after operation. Before operation, visual acuity was recorded in each patients with the help of Snellen's chart. First uncorrected visual acuity was recorded and best corrected visual acuity was done with auto refraction and recorded. Specular microscopy was done and mean endothelial cell density was calculated before operation, 1st week, 4th week and 12th week after operation. As shown in table 1, no significant difference was present in mean endothelial cell density preoperatively and 1st, 4th and 12th week postoperatively. Central corneal thickness (CCT) was calculated preoperatively and at 1st, 4th and 12th week postoperatively. A maximum corneal thickness was reached at 1st postoperative visit and decreased gradually to reach the preoperative values by 12th week. However, as shown in table 2 no significant difference was found. All patients underwent refractions at 12th week after operation.

Table I: Mean endothelial cell density

Preoperative	1 st week post operatively	4 th week post operatively	12 th week post operatively
2620 ± 70.20 /mm ²	2420 ± 68.90/ sq.mm % loss from preoperative to 1st week : 7.63%	2345 ± 66.64/ sq. mm % loss from 1st week to 4th week : 3.09%	2310 ± 66.04/sq. mm % loss from 4th week to 12th week : 1.49%

Table II : Corneal pachymetry

Preoperative	1 st week	4 th week	12 th week
530 ± 40.90 micrometer	545 ± 40.50 micrometer	535 ± 40.02 micrometer	532 ± 39.85 micrometer

Table III: Preoperative visual status

Visual acuity	
>6/18	0
6/24	5
6/36	6
6/60	4
5/60	7
4/60	8
3/60	2
2/60	0
1/60	1
<1/60	0

Table IV: BCVA at 12th postoperative week

6/6	4
6/9	6
6/12	8

6/18	6
6/24	7
6/36	2
6/60 or less	0

Discussion:

Cataract extraction by phacoemulsification was introduced in 1968 in New York by Charles Kelman⁹. In phacoemulsification, many methods have been described for removal of the lens nucleus which can be divided into sculpting method and chopping method. In sculpting method, divide and conquer is safe and technically simple to perform because there is lot of room within the capsular bag to handle the nucleus. Stop and chop method is a variation of chopping method that provides room in capsular bag for manipulation for nucleus and helps in removal of first nuclear fragments. In this technique, which was first described by Dr. Paul Koch, a central groove is first sculpted and the nucleus is divided into 2 halves or hemi nuclei. The surgeon then stops sculpting and commences chopping to make each half into smaller manageable pieces. We conducted this study on 33 patients. And phacoemulsification was done by stop and chop method. All patients were followed up 1st, 4th and 12th weeks after operation to see the central corneal thickness (CCT) and endothelial cell count and statistical studies were done. In our study, the mean age group of patient was 60.96 with standard deviation 1.75 years. Visual acuity of all patients were evaluated pre operatively and after 12th week postoperatively. Mean endothelial cell density was determined by specular microscopy pre operatively as well as 1th, 4th and 12th week after surgery. The preoperative mean endothelial cell density was $2620 \pm 70.20 / \text{mm}^2$. These values have a similarity with Brightbill findings who shown that mean endothelial cell count in late adulthood is around $2500 \text{ cell} / \text{mm}^2$ and Indians have slightly lower counts¹⁰. At 1st postoperative week, endothelial cell loss was 7.63%. At 4th postoperative week, there was further decrease in endothelial cell loss 3.09%. At 12th postoperative week, there was further decrease in endothelial cell loss 1.49%. This findings were similar to a study which was done by Shao-wei and coworkers who found an average endothelial cell loss of 9.74% in 107 patients of phacoemulsification at 1st postoperative week¹¹. All patients underwent central corneal thickness preoperatively and postoperatively at 1st, 4th and 12th week. Mean preoperative values were 530 ± 40.90 micrometer. After 1st, 4th and 12th postoperative week, the central corneal thickness was 545 ± 40.50 micrometer, 535 ± 40.02 micrometer, 532 ± 39.85 micrometer respectively. The similarity of results is supported by a study done by Srinivisan et al. who found that there was initial loss of endothelial cell count, increase in central corneal thickness and these values subsequently become normal after 12th weeks of surgery¹².

Conclusion:

The technique of nuclear management by stop and chop is highly effective. The endothelial cell loss and central corneal thickness changes are not significantly affected in this method done by the surgeons who gained experiences in different techniques of nuclear management in phacoemulsification.

Conflict of Interest: None.

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