

## Comparison of surgical and visual outcomes following capsulotomy using the envelope and continuous curvilinear capsulorhexis technique in manual small incision cataract surgery

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**ABSTRACT**

**Background & Objectives:** Capsulotomy is one of the important step in cataract surgery which can affect the surgical outcomes. The aim of the study was to compare the outcomes of envelope and continuous curvilinear capsulorhexis technique in manual small incision cataract surgery (MSICS).

**Materials & Methods:** A total of 72 eyes of 72 patients undergoing MSICS were studied. The patients were equally divided into two groups i.e. 36 patients each in envelope capsulotomy (Group A) and continuous curvilinear capsulotomy (CCC) group (Group B). **Results:** Mean surgical time ( $\pm SD$ ) in Group A was 355.83 sec  $\pm$  37.79 sec and in Group B was 375 sec  $\pm$  31.214 ( $p=0.02$ ). Uncorrected visual acuity on postoperative day 1 was 6/9 or better in 50% (18) cases in Group A and in 36% (13) cases in Group B ( $p=0.28$ ). Best corrected visual acuity (BCVA) on post-operative week 12 was 6/9 or better in 30.6% (n=11) cases in Group A and in 36% (n=13) cases in Group B ( $p=0.43$ ). On 12th week postoperatively, Grade 2 posterior capsular opacification (PCO) was seen in 30.6 % (n=11) cases of Group A and in 16.6 % (n=6) cases of Group B ( $p=0.17$ ). **Conclusion:** CCC technique can be considered superior to envelope technique for long term visual rehabilitation.

**Key words:** Capsulotomy, CCC, Envelope

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**INTRODUCTION**

Cataract, the leading cause of blindness, accounts for nearly 50% of blindness worldwide.<sup>1</sup> It is estimated that in Nepal there are 429,000 eyes as backlog of cataract blind eyes (BCVA <6/60) which accounts for almost 75% of all cases of blindness.<sup>2</sup> Extra Capsular Cataract Extraction with posterior chamber intraocular lens implantation is considered the safest and most effective means of restoring visual function in developing countries.<sup>3</sup> Capsulotomy plays a vital role in the further progress of surgical procedure of cataract extraction. A properly sized capsulotomy with better technique enhances surgical safety, hydrodissection, cortical clean up, IOL centration and inhibits posterior capsule opacification.<sup>4</sup> The most commonly used techniques are can-opener technique, envelope technique and Continuous Curvilinear Capsulorhexis (CCC). Purpose of this study was to analyze the intra-operative and post-operative complications, compare the post-operative visual outcome and find out the difference

in rate and grade of posterior capsular opacification following the use of envelope and CCC techniques for anterior capsulotomy in MSICS.

**MATERIALS AND METHODS**

Cases of age related cataract undergoing MSICS at the department of ophthalmology, BPKIHS fulfilling the inclusion criteria were included in the study. Ethical clearance was obtained from institutional research committee. All the investigations and surgical procedures were carried out after obtaining informed written consent from the patients. Sample size calculated using internet software Sealed EnvelopeTM power (sample size) calculator. Sample size required per group was 36. Study duration was of one year (15th February 2012 to 14th February 2013). Inclusion criteria included patients diagnosed as age related cataract and undergoing MSICS. Exclusion criteria included history of previous intraocular surgery, patient diagnosed as presenile cataract, traumatic cataract, complicated cataract or subluxated lens due to

various reasons, patient operated under guarded visual prognosis and those who declined for regular follow up for study.

### Parameters studied

Intra operative complications, time required to perform capsulotomy, postoperative visual outcome and immediate postoperative complications like iritis, corneal edema and Descemet's fold. Iritis classified according to SUN Working Group Grading Scheme for anterior chamber cells.<sup>5</sup> Postoperative complications like posterior capsular opacification and decentration of the IOL. Posterior capsular opacification was graded according to the slit lamp findings, clarity of the fundus view with direct ophthalmoscope and extent of decrease in best corrected visual acuity.<sup>6-7</sup>

### Statistical analysis

The two groups were compared to find out the difference in the variables. Collected information was entered in EXCEL computer software. Statistical parameter was calculated by using SPSS 17.0 computer software. Chi-Square test for categorical data and t-test for numerical data was used in this study. The "p" value of less than 0.05 was considered statistically significant.

### Preoperative evaluation

In all the patients, demographic data, detailed clinical history, general physical examination and ophthalmological examination were carried out. All patients were examined for visual acuity by Snellen's chart, refractive error by retinoscopy and refraction, intraocular pressure by applanation tonometer, lacrimal syringing for patency of the lacrimal drainage system, keratometry and biometry to calculate the IOL power, detailed slit lamp

examination, fundus evaluation with slit lamp biomicroscopy. Patients were randomly divided into two groups using simple randomization technique. Group A: Subjects underwent MSICS with anterior capsulotomy by envelope technique. Group B: Subjects underwent MSICS with anterior capsulotomy by CCC technique.

### Operative procedure

Pupil dilated using 1% tropicamide with 2.5% phenylephrine eye drops. Peribulbar anesthesia was given. All the steps of MSICS were similar in the two groups except for capsulotomy. Anterior capsulotomy in Group A patient was done by envelope technique and in Group B patient by CCC technique. Follow-up examination was done on the 1st postoperative day, 1st week, 6th week and 12th week postoperatively. Details were recorded by filling pro forma of the patient.

## RESULTS

A total of 72 eyes of 72 patients undergoing MSICS were studied. The patients were equally divided into two groups i.e. 36 patients each in envelope capsulotomy (Group A) and continuous curvilinear capsulotomy (CCC) group (Group B). Mean age of the subjects in years $\pm$  SD in Group A was 68.89  $\pm$ 8.67 and that in Group B was 66.38  $\pm$ 7.88. No statistically significant difference was found in the distribution of age (p= 0.70) or gender (p=0.14) among the two groups.

Mean surgical time ( $\pm$ SD) in Group A was 355.83 sec  $\pm$ 37.79 sec and in Group B was 375 sec  $\pm$ 31.214. Difference among the two group was statistically significant (p=0.02). Intra-operative iris trauma occurred in 14% (n=5) cases in ENV group

**Table 1:** Comparison of findings between the two groups on 1<sup>st</sup> POD

	Group A (n=36)	Group B (n=36)	P value
VA on 1 <sup>st</sup> POD > 6/9	18 (50)	13 (36)	P=0.28
Anterior chamber reaction grade 3 or more	2 (5.6)	7 (19.4)	P=0.01
Corneal edema and Descemet's folds $\geq$ 10	5 (14)	7 (19.4)	P=0.52

\*numbers in parentheses are the values in percentage

†Group A: Envelope technique, Group B: Continuous Curvilinear Capsulorhexis technique

**Table 2:** Comparison of findings between the two groups on 12<sup>th</sup> postoperative week

	Group A (n=36)	Group B (n=36)	P value
BCVA >6/9 on 12 <sup>th</sup> week Postoperatively	11 (30.6)	13 (36)	P=0.43
Centered optic	27 (75)	35 (97.2)	P=0.01
Grade 2 PCO	11 (30.6)	6 (16.6)	P=0.17

\*numbers in parentheses are the values in percentage

†Group A: Envelope technique, Group B: Continuous Curvilinear Capsulorhexis technique

where as none in CCC group. This was statistically significant ( $p=0.04$ ).

Post operative findings on day 1 were as listed in table 1.

Patients in ENV group had better vision in immediate postoperative period compared to that of CCC group, though this difference was not statistically significant ( $p=0.28$ ). More AC reaction was seen in CCC group than ENV group and this difference was statistically significant ( $p=0.01$ ). Corneal edema with Descemet's folds  $\geq 10$  were seen in more cases of CCC group than ENV group but this difference was not statistically significant ( $p=0.52$ ).

Findings on 12th postoperative week were as listed in table 2. BCVA 6/9 or better on post-operative week 12 was seen in more cases of CCC group. However this difference was not statistically significant ( $p=0.43$ ). Centered optic was observed in more cases of CCC group. The difference was statistically significant ( $p=0.01$ ). More occurrence of Grade 2 PCO was seen in ENV group, though this was not statistically significant ( $p=0.17$ ).

## DISCUSSION

Capsulotomy is one of the important step in cataract surgery. Among the several different types of anterior capsulotomy techniques, envelope and CCC techniques have been most widely used. There are certain benefits of one technique over the other. No statistically significant difference in base line variables like age and gender observed in the two groups and hence the two groups were comparable. Mean surgical time was less for the group with envelope technique. Though time duration required for envelope and CCC technique has not been mentioned in literatures, it has been mentioned that less experience and skill are required for envelope technique where as CCC require longer learning curve.<sup>8</sup>

Intraoperative and immediate postoperative complications were graded according to Oxford Cataract Treatment Evaluation Team (OCTET) grade.<sup>9-10</sup> Only OCTET grade 1 complications were observed in either group. Intra-operative iris trauma occurred more in envelope technique group which was statistically significant. This may be due to use of faulty vannas scissors used for capsulotomy, inadequate viscoelastics in the anterior chamber and contact of instruments with iris while performing capsulotomy. Uncorrected visual acuity 6/9 or better in immediate postoperative period was more

in envelope group than CCC group though not statistically significant. This may be due to enclosed system in envelope technique which caused less endothelial injury and less postoperative inflammation. But visual gain measured using WHO recommended method of postoperative visual status was equal in both the groups.<sup>11-13</sup> Patients may experience immediate visual recovery in whom anterior capsulotomy was done by envelope technique.

Severe anterior chamber inflammation was significantly less in envelope group than in CCC group. Also corneal edema and Descemet's fold were less in envelope group. And all of these can be attributed to the enclosed system of envelope technique i.e. endocapsular nucleus delivery, cortical aspiration and IOL implantation. The anterior capsular flap protected the endothelium and hence less complications like anterior chamber inflammation, corneal edema and Descemet's folds occurred. However a study conducted by Padmanabhan P showed that enveloped technique had no benefit over the other techniques regarding endothelial cell loss provided they are carefully done.<sup>14</sup>

Best corrected visual acuity 6/9 or better on 12th week post operatively was seen in more cases of CCC group than envelope group though not statistically significant. Also visual gain measured using WHO recommended method of postoperative visual status was better in CCC group.<sup>11-13</sup> This may be due to increased late postoperative complications in the envelope group.

Optic was decentered more frequently in envelope group than in CCC group and this was statistically significant. This result was consistent with the results of a study done by Cezmi et al in which IOL malposition was significantly more in group in which anterior capsulotomy was done by envelope technique.<sup>15</sup> Also study by Caballero A showed more IOL decentration in envelope group than CCC group.<sup>16</sup> This may be due to irregular shape and size of capsulotomy not corresponding to shape and size of the optic.

Occurrence of visually significant or Grade 2 PCO was seen more in envelope group than CCC group but it was not statistically significant. In a study conducted by Nikeghbali A significantly decreased incidence of PCO was seen in CCC compared to enveloped technique.<sup>14</sup> Our results were consistent with this study but due to shorter period of follow up it was not statistically significant in our study.

Also because of shorter period of follow up Grade 3 PCO was not seen in our study. The decrease in rate of visually significant PCO in CCC group could be due to adhesion between edges of the anterior capsular flap and posterior capsule which prevented growth of retained epithelial cells into the visual axis.

## CONCLUSION

Late postoperative visual outcome was better in group with CCC technique. This was due to less occurrence of late postoperative complications like tilt and decentration of IOL and PCO. CCC technique can be considered superior to envelope technique for long term visual rehabilitation.

## LIMITATIONS OF THE STUDY

Measurements of certain parameters like amount of tilt and decentration of IOL could not be done. The effect on quality of vision like glare and retinal image problems like halos and shadowing were not considered.

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