

Comparison of outcomes following combined ECCE-trabeculectomy versus phacoemulsification-trabeculectomy

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Purpose: To analyze and compare the main outcomes between trabeculectomies combined with extracapsular cataract extraction (ECCE) versus those with phacoemulsification (Phaco).

Patients and Methods: The authors retrospectively reviewed one surgeon's 357 consecutive cases (475 eyes) of combined cataract extraction, intraocular lens implantation and Mitomycin enhanced trabeculectomy. Patients were divided into two groups, those who underwent extracapsular cataract extraction (80 eyes) and those having phacoemulsification (395 eyes). Analysis of postoperative visual acuity, intraocular pressure (IOP), number of glaucoma medications, postoperative adverse events and additional procedures required, was done. Minimum follow-up was 12 months with an average of 53 months.

Results: There was no significant difference ($p=1.000$) between the groups in terms of visual acuity improvement rate, 66% (ECCE) versus 59% (Phaco). Postoperatively IOP with both techniques fell

significantly ($p < 0.0001$). Earlier IOP reduction was obtained with Phacoemulsification, but there was no difference by the end of the follow up period (14.4 mmHg ECCE vs. 14.1 mmHg Phaco, $p = 1.0000$). Postoperative pressure spikes occurred in 6% versus 10% ($p = 0.3995$) of the eyes. No significant difference (55% ECCE versus 63% Phaco, $p = 0.1674$) between the two groups in terms of glaucoma medication reduction was found. The total number of postoperative complications (89% versus 68.5%) were significantly higher ($p = 0.0001$) in the ECCE-group, as well as the total number of eyes which required further interventions (86% versus 64%, $p = 0.0001$).

Conclusion: Both combined surgery techniques are effective and yielded similar long-term results. However phacoemulsification can decrease the post operative complications associated with this surgery.

Key Words: Combined triple surgery, Extracapsular cataract extraction, Phacoemulsification cataract extraction, Trabeculectomy, Glaucoma

Combined glaucoma and cataract surgery has gained increasing success over the past decade, because of technological advances and modifications in surgical techniques (1). The effectiveness of combined surgery for the treatment of coexisting glaucoma and cataract has long been under study. Comparisons between sequential surgery and combined procedures have shown mixed results, and current guidelines have been drawn for the indication of combined surgery (2).

During the 80's, the surgical technique of choice was combined trabeculectomy with extracapsular cataract extraction (ECCE) and posterior chamber lens implantation in patients with coexisting cataract and glaucoma. In the 1990's, small-incision cataract surgery by

phacoemulsification with foldable intraocular lenses replaced ECCE. This surgical technique along with pharmacologic modulation of wound healing for glaucoma filtering surgery, have been the most important factors contributing to a higher success rate, greater acceptance and relative safety of combined procedures (3).

The improvements of phacoemulsification over extracapsular surgery is expected to improve the results of combined procedures with better outcomes in both intraocular pressure control and visual acuity along with lower complication rates (2). Our study compared the outcomes between Mitomycin enhanced trabeculectomies combined with extracapsular cataract extraction (ECCE) versus phacoemulsification (PHACO).

Patients and Methods

We performed a retrospective study of one surgeon's (JN) consecutive 656 (475 patients) combined cataract extraction, intraocular lens implantation, and

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trabeculectomy surgeries (from January 1, 1990, to December 31, 2002) in a sub-urban community in the San Juan metropolitan area of Puerto Rico. The patients were divided into two groups; one underwent extracapsular cataract extraction and intraocular lens implantation combined with mitomycin enhanced trabeculectomy (ECCE/Trab) and the other had phacoemulsification as the cataract removal method (Phaco/Trab). We analyzed and compared the main outcomes including postoperative visual acuity, intraocular pressure, number of glaucoma medications, postoperative adverse events and additional procedures required. Also the intraocular pressures were analyzed and compared postoperatively at day one, one week, one, three and six months and yearly for five years.

The minimum follow-up period for inclusion in this study was 12 months. Descriptive statistics and statistical analysis were done using a paired *t* test and Fischer's exact test.

Results

A total of 475 eyes (357 patients) qualified for this study. Eighty eyes (17%, 72 patients) underwent ECCE/Trab and 395 eyes (83%, 285 patients) had Phaco/Trab. The proportion of right to left eyes were similar, 48% OD (48% ECCE, 49% Phaco) vs. 52% OS (53% ECCE, 51% Phaco). There were 208 females (58%) (63% ECCE, 57% Phaco) and 149 males (42%) (38% ECCE, 43% Phaco). Ages ranged from 54 to 92 years (average 76 years) in the ECCE group and from 14 to 99 years of age (average 75 years of age) in the Phaco group. The follow up period in each group range from 12 months to 169 months, with an average of 53 months.

The type of glaucoma was identified in each patient; Primary Open Angle Glaucoma was the most common diagnosis (77%) (70% ECCE, 78% Phaco), followed by Chronic Angle Closure Glaucoma (14%) (16% ECCE, 14% Phaco), Mixed Mechanism Glaucoma (3.4%) (3% ECCE, 4% Phaco), Normal tension glaucoma (1.5%) (5% ECCE, 2% Phaco) and Pseudoexfoliation glaucoma (1.5%) (4% ECCE, 1% Phaco). Uveitic, Angle recession, Acute angle closure glaucoma and Neovascular glaucoma comprised less than 1% of cases.

Analysis of postoperative visual acuity outcomes was performed by surgical technique. Of the eyes that underwent ECCE/Trab, 53 (66%) had improved visual acuity, 18 (23%) did not change, and 9 (11%) were worse. Of those having Phaco/Trab, 232 (59%) showed improvement, 115 (29%) had stayed the same and 48 (12%) had further loss of vision. The causes of visual acuity deterioration are listed in Table 1. Of note, 52% of all patients showing loss of vision had an initial improvement

Table 1. Causes of Visual Acuity Deterioration

Causes of worsening	# of cases
ARMD	15
Progression of glaucoma	9
Vein occlusion	8
Diabetic retinopathy	6
Corneal edema	5
Choroidals	4
Epiretinal membrane	3
Ischemic optic neuropathy	2
Cerebrovascular accident	2
Retinal detachment	2
Epithelial Downgrowth	1
Total	57

in their visual acuity only to succumb as the follow up period increased.

Pre and post-operative intraocular pressures (IOP) were studied. The average pre-op IOP was 21.3 mmHg in the ECCE/Trab group and 23 mmHg in the Phaco/Trab one. Post operatively the IOPs had decreased equally in both groups to an average of 14.3 mm Hg. Distribution of the average post-op intraocular pressures by surgical technique during the follow up period are shown on Table 2. Intraocular pressure spikes (>10 mmHg) after surgery were recorded in 10% (6% in ECCE vs. 10% in Phaco) of the eyes.

Table 2. Distribution of IOPs by Surgical Technique During the Follow Up Period

Follow up	IOP average by Surgical Technique	
	ECCE	PHACO
Pre-OP	21.3	23
Day 1	26	18.9
1 week	15.75	16.3
1 month	22.8	14.8
3 months	17.1	14.7
6 months	16.3	14.7
1 year	17.2	14.6
2 years	15.2	14.9
3 years	15.25	14
4 years	20.3	14
5 years	14.4	14.1

A combined average of 2.28 antiglaucoma medications were used by patients prior to surgery, 2.24 in the ECCE and 2.32 in Phaco group. Post operatively, these were reduced to an average of 0.63, 0.7 in the ECCE group and 0.55 in Phaco. The distribution of pre and post-op glaucoma medications by surgical technique is seen in Table 3.

The complications seen during the follow up period are listed in Table 4. The most common problem was scarring

Table 3. Distribution of Pre and Post-op Glaucoma Medications by Surgical Technique

		Pre-Op Medications					
		Number of medications					
Surgery	Average	4	3	2	1	0	Total
ECCE	2.24	8%	29%	45%	15%	3%	80
Phaco	2.32	6%	36%	44%	12%	2%	395
Total	2.28	7%	35%	44%	12%	2%	475

		Post-Op Medications					
		Number of medications					
Surgery	Average	4	3	2	1	0	Total
ECCE	0.7	0%	1%	20%	24%	55%	80
Phaco	0.55	0.5%	3.5%	14%	19%	63%	395
Total	0.63	0.4%	2.6%	15%	20%	62%	475

Table 4. Complications Seen During the Follow Up Period

Complications	Cases by Surgical Technique		
	ECCE	PHACO	Total
Scarred bleb	53%	39%	41%
Choroidal Detachment	13%	7%	8%
Bleb leak	0%	5%	4%
Vein Occlusions	8%	2%	3%
Corneal decompensation	5%	3%	3%
Retinal Detachment	1%	1%	1%
Endophthalmitis	0%	0.5%	0.4%
Others	9%	11%	11%
Total	89%	68.5%	71.4%

of the filtering bleb in 41% of the cases (53% in the ECCE group and 39% in the Phaco group) and choroidal detachments in 8% (13% ECCE vs. 7% in Phaco).

Additional procedures were required during the follow up visits (Table 5). The most common was Laser Suture

Table 5. Additional Procedures Required During the Follow Up Visits

Additional Procedures	Cases by Surgical Technique		
	ECCE	PHACO	Total
Laser Suture Lysis	43%	33%	35%
YAG Capsulotomy	12.5%	7%	8%
Trabeculectomy	10%	4%	5%
Bleb Revision	1.25%	6%	5%
Valve	8.75%	4%	5%
Needleling	0%	4%	3%
Choroidal Drainage	5%	2%	2%
PPV	1.25%	1%	1%
PRP	2.5%	1%	1%
Others	2.5%	3%	3%
Total	86%	65%	68%

Lysis in 35% (43% ECCE, 33% Phaco), followed by YAG capsulotomy in 8% (13% ECCE, 7% Phaco) of the cases.

Discussion

Combined triple surgery—cataract extraction, intraocular lens implantation, and filtering procedure—has evolved from planned extracapsular cataract extraction to small-incision phacoemulsification (2). The technique of the filtration surgery has also undergone changes to enhance the success rate such as anti-fibrosing agents, releasable and adjustable sutures, laser suture lysis and non-penetrating procedures. The improvements in both parts of the surgery have led to an increased usage of this alternative when dealing with patients having coincident cataracts and glaucoma, possibly resulting in better outcomes.

However, there are cases where ECCE might be a safer alternative for the patient such as rock hard cataracts, Fuchs's dystrophy, extremely shallow chambers, poor zonular support and with less experienced phaco surgeons. Also, ECCE may be the alternative of choice in less developed countries where the cost of the equipment involved for phacoemulsification is prohibitive. One has to ask therefore if the outcomes are really worse when trabeculectomy is combined with ECCE rather than Phaco. If this is the case, are we subjecting our patients to a less effective procedure and doing them a disservice? The literature offers us conflicting results, some finding no difference in outcomes and others clearly favoring Phaco/Trab. Chia and Goldberg (4) stated that both ECCE/Trab and Phaco/Trab procedures are safe and effective. However, the Phaco/Trab procedure may have slightly improved IOP control, earlier visual recovery and less astigmatism (4). The present retrospective study was performed in an attempt at answering this question in a Puerto Rican community.

The visual acuity improvement rate was 66% in the ECCE group and 59% in the Phaco group. This difference did not reach statistical significance ($p = 1.0000$). Our findings best compared with Shingleton and co-workers (5) that found no significant difference between the groups in terms of visual acuity improvement. The lack of significant difference found in our study may be due to our analysis of the visual acuities after and average of four and a half years. Although not evaluated, the Phaco group may have had a faster recovery because of the smaller incision involved with less inflammation and induced astigmatism.

By the end of the follow up period, both cataract extraction techniques were equally effective in reducing

IOPs, from 22.2 mmHg to 14.3 mmHg. This reduction of 7.9 mmHg (36%) is considered statistically significant ($p < 0.0001$) and correlates with Chia and Goldberg (4) who found that postoperative, intra-ocular pressures fell significantly ($P < 0.005$) in both groups. Chia and Goldberg⁴ also reported that initially, IOPs fell roughly by the same amount at 3 months ($P = 0.84$) and that at 12 months, IOP in the Phaco group was slightly lower than that in the ECCE group ($P = 0.0312$). In our study when reductions in IOPs at 3 and 12 months were compared between surgical techniques, the IOP in the Phaco group was slightly lower than in the ECCE group, but the difference did not reach statistical significance in either one of the periods ($p = 0.0808$, $p = 0.4659$). Although there was a statistical difference ($p = 0.0426$) between the two groups in the IOP at post-op day number one, there was no statistical difference through out the rest of the follow up period between the two groups.

Wishart and Austin (6) observed early postoperative pressure spikes in 32% of the ECCE eyes and in 23.5% of the Phaco eyes. We detected pressure spikes in 6% of the ECCE eyes and 10% in the Phaco eyes, this difference was not statistically insignificant ($p = 0.3995$). Throughout the follow up period, we became aware that a stable IOP was reached earlier in the Phaco group (one month) than in the ECCE group (three months), as depicted in Figure 1. Although an earlier IOP reduction was obtained with Phaco, by the end of the follow up period both techniques had reached the designated target IOP of 15mmHg, indicating that they were both effective in lowering the intraocular pressure.

Previous studies by Wedrich and co-workers (7) established that there was a tendency towards a higher number of patients without therapy after surgery in the Phaco group (82%) versus the ECCE group (65%). Our study found 55% of the eyes in the ECCE group did not require medication versus 63% in the Phaco group. Although there is a tendency favoring Phaco, the difference was not statistically significant ($p = 0.1674$). In the ECCE

group 45% of the patients required further medication compared with 37% in the Phaco group. The difference in the number of medications required to control the IOP after surgery between the surgical techniques was not significant. These results best correlate with Stewart and co-workers (8) that found no significant difference between the two groups, in terms of the number of glaucoma medications prescribed postoperatively.

Wedrich and co-workers (7) recognized that postoperative complications such a filtering bleb scarring, severe fibrin effusion and the total number of complications were significantly higher in the ECCE-group (87% versus 63%). We found a significant statistical difference ($p = 0.0001$), between the total postoperative complications in the ECCE and the Phaco group (89% vs. 68.5%). The most common postoperative complication was bleb scarring, which was greater in the ECCE group (53% vs. 39% Phaco) ($p = 0.0251$). Tezel and co-workers (9) stated that phacoemulsification had lowered the postoperative complication rate previously associated with extracapsular cataract extraction combined with trabeculectomy. Phacoemulsification combined with filtering surgery requires a smaller conjunctival and scleral incision, with an associated reduction in inflammation. Since inflammation is responsible for the greater risk of bleb scarring, this technique may well reduce this complication possibility enhancing bleb formation and long-term intraocular pressure control.

Picht and co-workers (10) found that in the postoperative period after a trabeculectomy, 45.1% of the eyes needed further interventions for long-term success. In our study we found that 68% of the eyes required further interventions. When categorized by surgical technique a significant statistical difference ($p < 0.0001$) was found between the total additional procedures required during the follow up visits in the ECCE group (86%) versus the Phaco group (64%). We expected this difference since the ECCE group was previously found to have more post surgical complications and would therefore require additional procedures to resolve the problems.

In summary, both techniques resulted in visual acuity improvement, fewer required post-op medications and in a decrease in intraocular pressure, without any significant long-term difference between the two groups. Although an earlier IOP stabilization was noticed in the Phaco group, both techniques were equally effective in achieving the target IOP (≤ 15 mmHg) at the end of the follow up period. The number of postoperative complications and additional procedures were significantly higher in the ECCE group but were also seen fairly frequently when phacoemulsification was performed. Even though these complications were those inherent to filtration surgery,

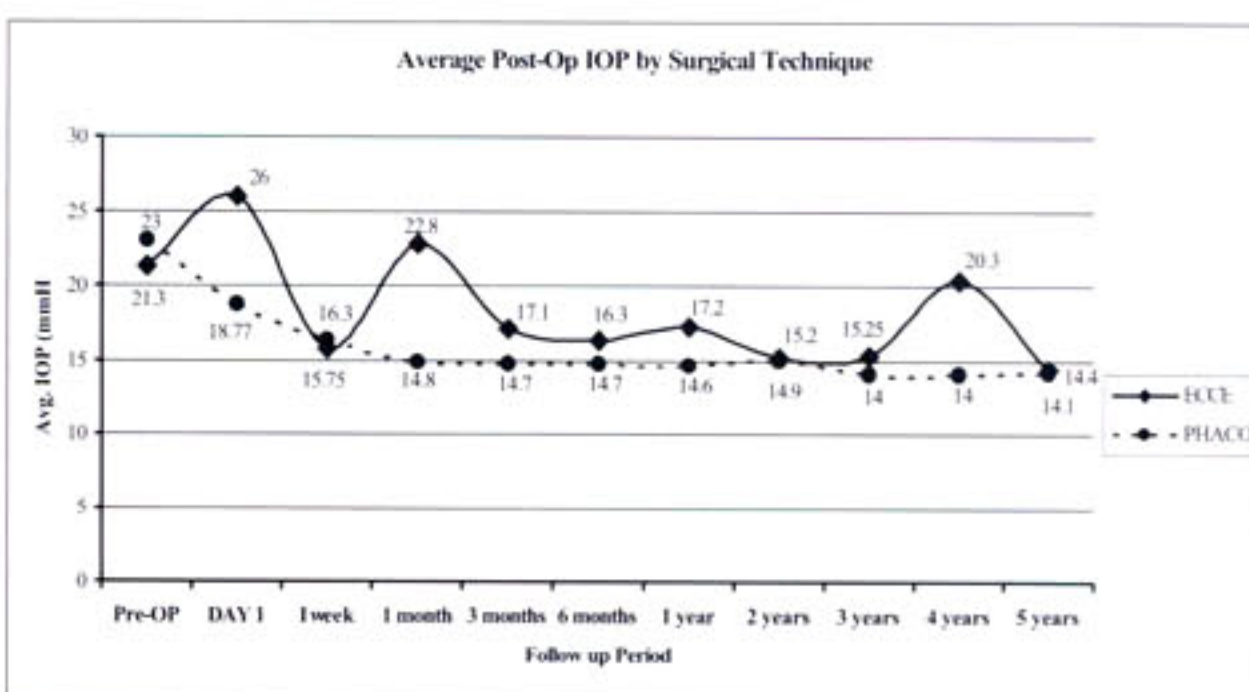


Figure 1. Average Post –Op IOP by Surgical Technique

the cataract removal technique may well influence the results.

Our experience leads us to conclude that both combined surgery techniques are effective and yields similar long-term results for our patients with coexisting glaucoma and cataract. Should ECCE be required as the cataract removal technique in a given combined case, one can feel confident that the patient can have as good a result as those found with phacoemulsification; however phacoemulsification can decrease the post operative complications associated with combined triple surgery.

Resumen

Propósito: Analizar y comparar los resultados principales entre la trabeculectomía combinada con la extracción extracapsular de la catarata (ECCE) contra éstos con el facoemulsificador (Phaco).

Pacientes y métodos: Los autores repasaron retrospectivamente 357 (475 ojos) casos consecutivos de cirugía combinada de catarata, con implantación de lente intraocular y uso de Mitomicina en la trabeculectomía, hechos por una de los autores. Los pacientes fueron divididos en dos grupos, aquellos en el cual la catarata se extrajo extracapsularmente (80 ojos) y en los que se usó facoemulsificación (395 ojos). Análisis post operatorio de la agudeza visual, presión intraocular (PIO), número de medicamentos anti-glaucoma, eventos post operatorios adversos y procedimientos adicionales requeridos, fue hecho. El tiempo mínimo de seguimiento fue de 12 meses con un promedio de 53 meses.

Resultados: No hubo diferencia significativa ($p=1.000$) entre los grupos al comparar la mejora en agudeza visual, 66% (ECCE) versus 59% (Phaco). La presión intraocular post operatoria se redujo significativamente en ambos grupos ($p<0.0001$). Una reducción mas temprana en la presión intraocular fue obtenida en el grupo de facoemulsificación, pero al final del periodo de seguimiento no hubo diferencia entre estos (14.4 mmHg ECCE vs. 14.1 mmHg Phaco, $p = 1.0000$). Picos en la presión intraocular ocurrieron en 6% (ECCE) versus 10% (Phaco) ($p = 0.3995$) de los ojos. No hubo diferencia significativa (55% ECCE versus 63% Phaco, $p = 0.1674$) entre ambos grupos en términos de reducción en el uso de medicamentos anti-glaucoma. El numero total de

complicaciones post operatorias (89% versus 68.5%) fue significativamente mayor ($p= 0.0001$) en el grupo de ECCE, al igual que el total de ojos que requirieron procedimientos adicionales (86% versus 64%, $p= 0.0001$).

Conclusión: Ambas técnicas de cirugía combinada son efectivas y proporcionan resultados similares a largo plazo. Sin embargo la facoemulsificación puede disminuir las complicaciones post operatorias asociadas a este procedimiento.

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