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## Comparison between the outcomes of combined phaco/trabeculectomy by cataract incision site

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**Purpose:** To analyze and compare the main outcomes of two techniques of combined surgery; mitomycin enhanced trabeculectomy combined with phacoemulsification and intraocular lens implantation through a single incision versus a two incisions approach.

**Patients and Methods:** The authors retrospectively reviewed one surgeon's consecutive 395 combined phacoemulsification/trabeculectomy surgeries. Patients were divided into two groups, those who underwent phacoemulsification and intraocular lens implantation through one incision (Phaco 1) and the other through two incisions (Phaco 2), both combined with trabeculectomy. Analysis of postoperative visual acuity, intraocular pressure, number of glaucoma medications, postoperative adverse events and additional procedures required, was done. Minimum follow-up was 12 months with an average of 49.2 months.

**Results:** There was a significant difference ( $p = 0.0237$ ) between the groups in terms of visual acuity

improvement rate. By the end of the follow up period, both techniques were equally effective in reducing IOPs by an average of 8.1 mmHg. Postoperative pressure spikes occurred in 9% versus 11% ( $p = 0.6838$ ) of the eyes. No significant difference (63% Phaco 1 versus 69% Phaco 2,  $p = 0.3230$ ) between the two groups in terms of glaucoma medication reduction was found. There was no significant difference ( $p = 0.1181$ ), in the total postoperative complications between the two groups (60% Phaco 1 vs. 51% Phaco 2), as well as in the total number of eyes which required further interventions (60% versus 68%,  $p = 0.2223$ ).

**Conclusion:** Combined phacoemulsification/trabeculectomy using either a single or a two site approach, are equally effective in treating glaucoma patients with cataracts.

**Key Words:** Combined triple surgery, Phacoemulsification cataract extraction, Trabeculectomy, Glaucoma, Phacoemulsification/trabeculectomy through a single versus a two incisions approach

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Combined cataract removal and trabeculectomy is a less arduous task today than it was a decade ago because of technological advances and modifications in surgical technique (1). New sutureless and smaller incisions have become more popular, alternative filtration procedures have been developed and newer approaches at wound healing modulation are being evaluated and used. The greatest impact has been the employment of phacoemulsification for the cataract removal segment of the operation. The smaller incision involved and the reduced post-op inflammatory reaction has helped

reduce the incidence and severity of complications. Moreover, less induced astigmatism and a quicker visual recovery is expected when compared to ECCE and may result in a shorter recovery period.

The opportunity to perform this procedure through the same incision used in the trabeculectomy versus separating them into two independent incisions have sparked a controversy as to which of the two techniques lead to better outcomes.

Our study compared the outcomes of two techniques of combined surgery; Mitomycin enhanced trabeculectomy combined with Phacoemulsification and intraocular lens implantation through a single versus a two incisions approach.

### Patients and Methods

We performed a retrospective study of one surgeon's (JN) consecutive 395 (301 patients) combined cataract

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extraction, intraocular lens implantation, and trabeculectomy surgeries (from January 1, 1992, 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 phacoemulsification and intraocular lens implantation through one incision (Phaco 1) combined with mitomycin enhanced trabeculectomy and the other had Phacoemulsification and intraocular lens implantation through two incisions (Phaco 2).

**Surgical technique:** Topical anesthesia with IV sedation was used in both techniques. Either a limbus or fornix based conjunctival flap was fashioned after which two Mitomycin soaked pledgetts were placed subconjunctivally for five minutes and irrigated copiously with BSS. A rectangular scleral flap was dissected superiorly. In the Phaco 1 technique, the anterior chamber was entered under the scleral flap with a 2.7 mm keratome and after capsulorhexis, phacoemulsification with intraocular lens implantation was performed through this incision. A sclerotomy was made under the scleral flap with a punch followed by a peripheral iridectomy and suturing of the scleral and conjunctival flaps with 10-0 nylon. In the Phaco 2 technique, a temporal clear corneal incision was used for the cataract portion which was closed by stromal hydration. The glaucoma portion was identical to the Phaco 1 procedure.

We analyzed and compared the main outcomes including postoperative visual acuity, intraocular pressure, number of glaucoma medications, postoperative adverse event, 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 and unpaired *t* test and Fischer's exact test.

## Results

A total of 395 eyes (301 patients) qualified for this study. 302 eyes (76%, 235 patients) underwent Phaco 1 and 93 eyes (24%, 81 patients) had Phaco 2. The proportion of right to left eyes were similar, 49% OD (47% Phaco 1, 53% Phaco 2) vs. 51% OS (53% Phaco 1, 47% Phaco 2). There were 176 females (58%) (61% Phaco 1, 49% Phaco 2) and 125 males (42%) (39% Phaco 1, 49% Phaco 2). Ages ranged from 14 to 99 years (average 74.8 years) and the follow up period from 12 months to 130 months, with an average of 49.2 months.

The type of glaucoma was identified in each patient;

Primary Open Angle Glaucoma was the most common diagnosis (78%) (76% Phaco 1, 85% Phaco 2), followed by Chronic Angle Closure Glaucoma (14%) (16% Phaco 1, 9% Phaco 2), Mixed Mechanism Glaucoma (4%) (4% Phaco 1, 2% Phaco 2), Normal tension glaucoma (2%) (3% Phaco 1, 0% Phaco 2) and Pseudoexfoliation glaucoma (1%) (0.3% Phaco 1, 3% Phaco 2). Angle recession, Acute angle closure glaucoma and Neovascular glaucoma comprised less than 1% of cases.

Analysis of post operative visual acuity outcomes was performed by surgical technique at the end of the follow-up period. Of the eyes undergoing Phaco 1, 171 (57%) had improved visual acuity, 83 (27%) did not change, and 48 (16%) deteriorated. Of those having Phaco 2, 64 (69%) showed improvement, 23 (25%) had stayed the same and 6 (6%) had further loss of vision. The causes of visual

**Table 1.** Causes of Visual Acuity Deterioration by Surgical Technique

	Causes of worsening		
	Phaco 1	Phaco 2	Total
ARMD	8%	3%	8%
Choroidals	8%	4%	7%
Vein occlusion	3%	1%	3%
DR	4%	1%	3%
Corneal edema	2%	1%	2%
ERM	1%	1%	1%
ION	0.6%	1%	0.8%
CVA	1%	0%	0.8%
RD	0.6%	1%	0.8%
Progress of glaucoma	0.3%	0%	0.3%
<b>Total</b>	<b>29%</b>	<b>14%</b>	<b>25%</b>

acuity deterioration by surgical technique are listed in Table 1.

Pre and post-operative intraocular pressures (IOP) were studied. The average pre-op IOP was 22.4 mmHg in the both groups. Post operatively the IOPs had decreased to an average of 13.7 mm Hg in the Phaco 1 group and to 14.9 mm Hg in the Phaco 2. The average post-op intraocular pressure in the Phaco 1 group at day one was 18.6 mmHg, at one week 15.8 mmHg, at one month 14.5 mmHg, at three months 14.7 mm Hg, at six months 14.7 mmHg, at one year 14.3 mm Hg, at two years 14.8 mmHg, at three years 13.9 mmHg, at four years 14.1 mm Hg and at five years 14 mm Hg. Meanwhile in the Phaco 2 group the average post-op intraocular pressure at day one was 20.9 mmHg, at one week 17.7 mmHg, at one month 15.5 mmHg, at three months 14.6 mm Hg, at six months 14.8 mmHg, at one year 15.3 mm Hg, at two years 15.2 mmHg, at three years 14.7 mmHg, at four years 12.5 mm Hg and at five years 13 mm Hg. Intraocular pressure spikes (>10 mmHg) after surgery where

recorded on 10% (9% in Phaco 1 vs. 11% in Phaco 2) of the eyes.

A combined average of 2.35 antiglaucoma medications were used by patients prior to surgery, 2.4 in the Phaco 1 group and 2.3 in Phaco 2. Post operatively, these were reduced to an average of 0.55, 0.6 in the Phaco 1 group and 0.5 in Phaco 2. Pre-operatively, a total of 27 (7%) eyes required 4 medications (6% in Phaco 1 vs. 8% in Phaco 2), 146 (37%) used 3 medications (39% in Phaco 1 vs. 31% in Phaco 2), 173 (44%) 2 medications (44% in both groups), 45 (11%) one medication (10% in Phaco 1 vs. 16% in Phaco 2) and 4 (1%) were on none (1% in both groups). After surgery a combined total of 2 (0.5%) eyes were on 4 medications (0.7% in Phaco 1 vs. 0% in Phaco 2), 15 (4%) on 3 medications (4% in both groups), 55 (14%) on 2 medications (15% in Phaco 1 vs. 12% in Phaco 2), 70 (18%) on one medication (19% in Phaco 1 vs. 15% in Phaco 2) and 253 (64%) didn't use any (63% in Phaco 1 vs. 69% in

**Table 2.** 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
Phaco 1	2.4	6%	39%	44%	10%	0.7%	302
Phaco 2	2.3	8%	31%	44%	16%	0%	93
<b>Total</b>	<b>2.35</b>	<b>7%</b>	<b>37%</b>	<b>44%</b>	<b>11%</b>	<b>1%</b>	<b>395</b>

Post-Op Medications							
Number of medications							
Surgery	Average	4	3	2	1	0	Total
Phaco 1	0.6	0.7%	4%	15%	19%	63%	302
Phaco 2	0.5	0%	4%	12%	15%	69%	93
<b>Total</b>	<b>0.55</b>	<b>0.5%</b>	<b>4%</b>	<b>14%</b>	<b>18%</b>	<b>64%</b>	<b>395</b>

Phaco 2). The distribution of pre and post-op glaucoma medications by surgical technique is seen in Table 2.

The complications seen during the follow up period are

**Table 3.** Complications Seen During the Follow Up Period

Complications	Cases by Surgical Technique		
	Phaco 1	Phaco 2	Total
Scarred bleb	35%	34%	35%
Choroidal Detachment	7%	9%	7%
Bleb leak	5%	4%	5%
Vein Occlusions	3%	1%	2%
Corneal decompensation	2%	0%	2%
Retinal Detachment	0.6%	0%	0.5%
Endophthalmitis	0.3%	2%	0.8%
Others	7%	0%	5%
<b>Total</b>	<b>60%</b>	<b>51%</b>	<b>58%</b>

listed in Table 3. The most common problem was scarring of the filtering bleb in 35% of the cases (35% in the Phaco 1 group and 34% in the Phaco 2 group) and choroidal detachments in 7% (7% Phaco 1 vs. 9% in Phaco 2).

Additional procedures were required during the follow up visits (Table 4). The most common was Laser Suture Lysis in 32% (29% Phaco 1, 42% Phaco 2), followed by

**Table 4.** Additional Procedures Required by Surgical Technique During Follow Up Period

Additional Procedures by Surgical Technique			
	Phaco 1	Phaco 2	Total
LSL	29%	42%	32%
YAG Capsulotomy	7%	4%	7%
Trabeculectomy	5%	3%	5%
Bleb Revision	4%	3%	4%
Valve	4%	3%	4%
Needleling	3%	5%	4%
Choroidal Drainage	1%	3%	2%
PRP	2%	0%	2%
PPV	0.7%	2%	1%
Others	4%	1%	3%
<b>Total</b>	<b>60%</b>	<b>68%</b>	<b>62%</b>

YAG capsulotomy in 7% (7% Phaco 1, 4% Phaco 2) of the cases.

## Discussion

The coexistence of cataract and glaucoma is fairly common as both conditions increase in frequency with age. Modern combined procedures that include antimetabolites and phacoemulsification has increased in popularity when dealing with these two conditions because of better outcomes and faster recovery. Some feel that separating the cataract incision from the trabeculectomy site might further increase the outcomes as the astigmatism can be more effectively addressed. Also postoperative inflammation might be reduced in the Phaco 2 technique leading to improved bleb survival and IOP control.

The visual acuity improvement rate at the end of follow up period was 57% in the Phaco 1 group and 69% in the Phaco 2 group. This difference reached statistical significance ( $p = 0.0237$ ). Other investigators (2,3) have reported similar corrected visual acuity improvements in both groups of patients. Because of the prolonged follow-up period in our study, other visual deteriorating conditions such as ARMD and Diabetic Retinopathy developed (greater in Phaco 1), which may be responsible for the observed difference independent of the surgical technique used.

By the end of the follow-up period, both cataract extraction techniques were equally effective in reducing IOPs by an average of 8.1 mmHg (36%) ( $p < 0.0001$ ). This finding correlates with Borggreffe and co-workers (4) who found that the preoperative mean intraocular pressure dropped significantly in both groups after surgery. In our study when reductions in IOPs at 1 week, 1 month, 3, 6, 12 months post operation were compared between surgical techniques, the IOP in the Phaco 1 group was slightly lower than that in the Phaco 2 group, but the difference did not reach statistical significance in either one of the time periods ( $p = 0.1041, 0.3447, 0.9067, 0.9790, 0.2412$ ). These findings are in agreement to Dong and co-workers (5) that reported no significant difference between the two groups in the mean postoperative IOPs in the same time periods.

We detected pressure spikes in 9% of the Phaco 1 eyes and 11% in the Phaco 2 eyes, a difference that was not statistically significant ( $p = 0.6838$ ). Throughout the follow up period, it became apparent that a stable IOP was reached

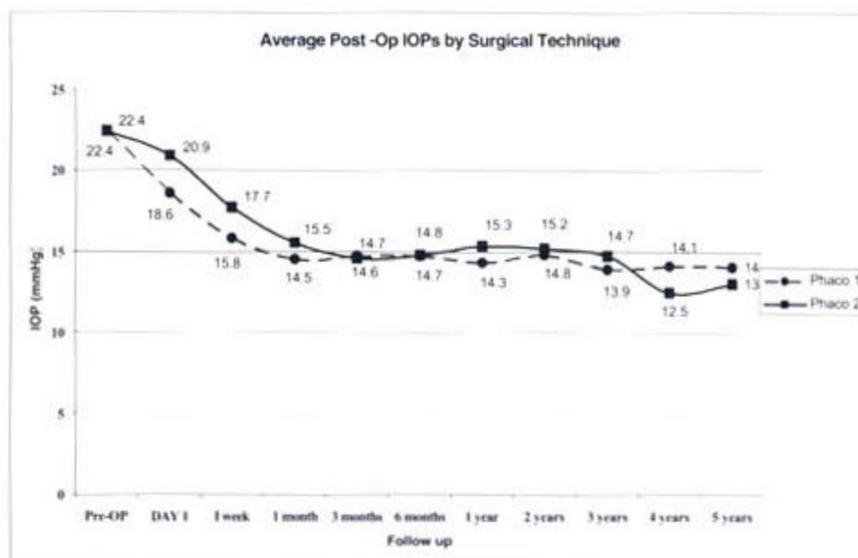


Figure 1. Average Post-op IOPs by Surgical Technique

by the same time period in both groups, at one month, as depicted in Figure 1. Wyse and co-workers (3) reported that the IOP decrease at last follow-up was not significantly different ( $P = .129$ ) between the one-site and two-site groups. In our study the difference in the mean IOP by the end of the follow up period of both groups was not statistically significant ( $p = 0.8073$ ) and both groups had reached the designated target IOP of 15mmHg, indicating that they were both effective in lowering the intraocular pressure.

Wyse and co-workers (3), reported that at the last follow-up visit, the one-site group required significantly more ( $p=0.30$ ) medications than did the two-site group. In our study 63% of the eyes in the Phaco 1 group did not require post-op glaucoma medications after surgery versus 69% in the Phaco 2 group. Although there is a tendency favoring Phaco 2, the difference was not statistically significant ( $p$

$= 0.3230$ ). This tendency could be due to the increased tissue manipulation in the single incision approach leading to an increased inflammatory response and scarring of the bleb. The difference in the number of medications required to control the IOP after surgery between the surgical techniques was not significant.

We found no significant difference ( $p = 0.1181$ ), between the total postoperative complications in the Phaco 1 and the Phaco 2 groups (60% vs. 51%). Our findings correlate with Rossetti and co-workers (6) who found no significant difference in complication rates between the two groups. The most common postoperative complication was bleb scarring, which was greater in the Phaco 1 group (35% vs. 34% Phaco 2), but not statistically significant ( $p = 0.9016$ ).

When categorized by surgical technique no statistical difference ( $p = 0.2223$ ) was found between the total additional procedures required during the follow up visits in the Phaco 1 group (60%) versus the Phaco 2 group (68%). Meanwhile we found a significant difference ( $p = 0.0218$ ) between the patients who required laser suture lysis in the Phaco 1 group (29%) versus those in the Phaco 2 group (42%).

In conclusion, combined phacoemulsification/trabeculectomy using either a single or a two site approach, is effective in treating glaucoma patients with cataracts. Improvements in visual acuity, intraocular pressure control and a decrease in the use of glaucoma medications were obtained in both groups. Furthermore, there were no differences in the number of post surgical complications or additional procedures required when both groups were compared. Theoretically, a two site approach should lead to improved results since astigmatism can be addressed, post-op inflammation may be reduced and wound distortion or burns at the trabeculectomy site from the phaco hand piece are not an issue. Nevertheless, our study as those of others, fail to show a significant improvement in results between both approaches. Regardless of the route a surgeon chooses to pursue, he may feel confident that the results obtained will be very good.

## Resumen

**Propósito:** Analizar y comparar los hallazgos principales de la cirugía combinada de facoemulsificación/trabeculectomía a través de una incisión versus dos incisiones.

**Pacientes y métodos:** Los autores repasaron retrospectivamente 395 casos consecutivos de cirugía combinada de catarata, usando un facoemulsificador, con implantación de lente intraocular y uso de Mitomicina en la trabeculectomía. Los pacientes fueron divididos en dos grupos, aquellos en el cual la facoemulsificación e

implantación de lente intraocular se hizo a través de una incisión (Phaco 1) y el otro a través de dos incisiones (Phaco 2). Análisis post operatorio de la agudeza visual, presión intraocular, 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 49.2 meses.

**Resultados:** Hubo una diferencia significativa ( $p = 0.0237$ ) entre ambos grupos al comparar la mejoría en la agudeza visual. Al final del periodo de seguimiento, ambas técnicas fueron igual de efectivas en reducir la presión intraocular, con una promedio de 8.1 mmHg. Picos en la presión intraocular ocurrieron en 9% (Phaco1) versus 11% (Phaco 2) ( $p = 0.6838$ ) de los ojos. No hubo diferencia significativa (63% Phaco 1 versus 69% Phaco 2,  $p = 0.3230$ ) entre ambos grupos, en términos de reducción en el uso de medicamentos. No se encontró diferencia significativa ( $p = 0.1181$ ), en el total de complicaciones post operatorias entre los grupos (60% Phaco 1 vs. 51% Phaco 2), al igual que en el número de ojos que requirieron intervenciones adicionales (60% versus 68%,  $p = 0.2223$ ).

**Conclusión:** Ambas técnicas estudiadas de la cirugía combinada facoemulsificación/trabeculectomía fueron

igual de efectivas en el tratamiento de pacientes con glaucoma y cataratas.

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