

Comparison of short-term results of phaco-trabeculectomy and trabeculectomy

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ABSTRACT

Purpose: To compare the effects of combined phaco-trabeculectomy and alone trabeculectomy on intraocular pressure (IOP).

Materials and Methods: Thirty six patients which underwent trabeculectomy; 25 of these patients were phakic (Group 1) and 11 were pseudo phakic (Group 2) and 23 patients which underwent phaco-trabeculectomy (Group 3) were included in this study. Best-corrected visual acuity (BCVA), IOP, and anti-glaucomatous drug information before and three months after surgery were registered and evaluated statistically.

Results: It was found that there wasn't a statistically significant difference between phaco-trabeculectomy and trabeculectomy groups regarding the preoperative mean IOP. Between the mean IOP of the three groups was observed a significant decrease after surgery compared to that before surgery. On the postoperative first day, in pseudophakic eyes after trabeculectomy, the numerical decrease in IOP was more significant than in the other groups, however, was not statistically significant. At the end of the third month, the mean IOP among the three groups was not different. It was found that there wasn't a statistically significant difference among the three groups regarding the addition of anti-glaucomatous drops. Although it was not statistically significant among the study groups regarding BCVA, a significant increase was observed in visual acuity, especially in patients who had undergone phaco-trabeculectomy.

Conclusion: Our study suggests that there is not a statistically significant difference regarding the effects of phaco-trabeculectomy and trabeculectomy on IOP reduction.

Keywords: Intraocular pressure, trabeculectomy, phaco-trabeculectomy, phakic, pseudophakic.

INTRODUCTION

Glaucoma is the second most common cause of irreversible blindness in the world. Approximately 70 million people are thought to have glaucoma worldwide.¹⁻³ With the increase in the elderly population, it is predicted that the number of glaucoma patients will increase.⁴ Trabeculectomy is the most common surgical method in glaucoma patients and it is the gold standard procedure. Trabeculectomy aims to create a passage for the aqueous humor through a filtering bleb into the subconjunctival space.⁵

Cataract surgery is the most common intraocular surgery method all over the world. It has been thought that up to 10% of cataracts cause ocular hypertension or glaucoma.^{6,7} On the other hand, phacoemulsification reduces intraocular

pressure (IOP).⁸⁻¹⁰ However, the reductive effect on IOP of phacoemulsification has not been fully explained.^{11,12} Trabeculectomy may be performed alone or in combination with phacoemulsification in glaucoma patients. In this study, we aimed to compare the effects on IOP of combined phaco-trabeculectomy and alone trabeculectomy.

MATERIALS AND METHODS

Between 2019 and 2021 years, electronic files of the patients who were admitted to the glaucoma unit in Department of Ophthalmology of Çanakkale 18 Mart University, and underwent trabeculectomy or phaco-trabeculectomy because of open-angle glaucoma were collected and retrospectively analyzed. This study was designed as a retrospective trial and followed the tenets of

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the Declaration of Helsinki. Approval by the institutional ethic committee was not needed due to the retrospective nature of the study. Fifty-nine patients were enrolled in the study. Patients who had moderate-severe pre-operative glaucomatous visual field defects as a mean deviation (MD) worse than -6 dB, visual field progression and inability to achieve adequate reduction in intraocular pressure despite maximum topical antiglaucomatous treatment underwent surgery. The patients who have not undergone intraocular surgery except for phacoemulsification, without a history of trauma, ocular inflammation, and infectious eye disease that may affect intraocular pressure (IOP), were included in the study. All patients with complications were excluded from the study. Best-corrected visual acuity (BCVA), IOP, and anti-glaucomatous drug information before and three months after surgery were registered.

Surgical Technique

Glaucoma surgery was performed with the same technique by the same surgeon (B.T) in a single center. In all eyes, a 4x4 mm partial thickness scleral flap with limbus base was created. 0.2 mg/ml mitomycin C impregnated sponges were applied on the scleral bed for 3 minutes. iridectomy was performed after washing with saline. scleral flap edges were closed with 10-0 and conjunctiva with 8-0 nylon suture. Glaucoma surgery combined with cataract surgery was performed in selected cases.

IOPs at the preoperative and postoperative first day, first week, first month, and third month were obtained by Goldman applanation tonometry, and the BCVAs were measured with a Snellen chart and established in three groups as group A (under the 0.05), group B (0.05-0.3) and group C (>0/3). At the end of the third month, those who needed topical anti-glaucomatous were noted.

Statistical Analysis

Statistical analysis was performed using the Statistical

Package for the Social Sciences (SPSS) version 11.0 (Chicago, IL, USA). Results were given as the means±standard deviations. The suitability of data to normal distribution was evaluated with the Kolmogorov-Smirnov test. Parametric tests or non-parametric tests were selected according to the situation. A p value less than 0.05 was considered statistically significant.

RESULTS

A total of 59 patients were included in the study. They ranged between 45-80 years. The follow-up period was 3 months. The mean age of the participants was 64.54 years; 20 of the patients were female and 39 of them were male. Trabeculectomy was performed in 36 patients. 25 of these patients were phakic and 11 were pseudophakic. 23 patients underwent phaco-trabeculectomy.

The mean IOPs of the patients before trabeculectomy and phaco-trabeculectomy were 24.86 mmHg and 25.39 mmHg, respectively. It was found that there wasn't a statistically significant difference between the two groups regarding the preoperative mean IOP. In phakic patients who underwent trabeculectomy, the mean IOP was 21.88 mmHg, 9.71 mmHg, 9.64 mmHg, 12,28 mmHg, 13,48 mmHg as before surgery, and 1st day, 1st week, 1st month, 3rd month after surgery, respectively (Table 1).

In pseudophakic patients who underwent trabeculectomy, the mean IOP was 31.64 mmHg, 9.36 mmHg, 10.18 mmHg, 13.00 mmHg, and 14.45 mmHg as before surgery, and 1st day, 1st week, 1st month, 3rd month after surgery respectively (Table 2). The mean IOPs of the patients with phaco-trabeculectomy were 25.39 mmHg, 13.13 mmHg, 17.35 mmHg, 14.55 mmHg, and 15.52 mmHg as before surgery, and 1st day, 1st week, 1st month, 3rd month after surgery, respectively (Table 3). Between the mean IOP of the three groups was observed a significant decrease after surgery. On the postoperative 1st day in pseudophakic eyes

Table 1: Intraocular pressure changes in the Phakic-Trabeculectomy group

| Intraocular Pressure | Preop | 1st day | 1st week | 1st month | 3rd month |
|----------------------|-------|---------|----------|-----------|-----------|
| N | 25 | 24 | 25 | 25 | 25 |
| Missing | 0 | 1st day | 0 | 0 | 0 |
| Mean | 21,88 | 9,71 | 9,64 | 12,28 | 13,48 |
| Median | 21 | 5 | 6 | 12 | 15 |
| Std. Deviation | 7,828 | 7,793 | 7,158 | 6,561 | 5,687 |
| Minimum | 11 | 2 | 3 | 2 | 2 |
| Maximum | 39 | 27 | 27 | 27 | 27 |

Std: Standard, Preop: Preoperative

Table 2: Intraocular pressure changes in the Pseudophakic-Trabeculectomy group

| Intraocular Pressure | Preop | 1st day | 1st week | 1st month | 3rd month |
|----------------------|-------|---------|----------|-----------|-----------|
| N | 11 | 11 | 11 | 11 | 11 |
| Missing | 0 | 0 | 0 | 0 | 0 |
| Mean | 31,64 | 9,36 | 10,18 | 13 | 14,45 |
| Median | 33 | 6 | 7 | 14 | 17 |
| Std. Deviation | 6,005 | 8,629 | 6,794 | 6,753 | 4,547 |
| Minimum | 17 | 3 | 4 | 4 | 7 |
| Maximum | 39 | 32 | 25 | 25 | 20 |

Std: Standard, Preop: Preoperative

Table 3: Intraocular pressure changes in the Phakic-Phacotrabeulectomy group

| Intraocular Pressure | Preop | 1st day | 1st week | 1st month | 3rd month |
|----------------------|-------|---------|----------|-----------|-----------|
| N | 23 | 23 | 23 | 22 | 23 |
| Missing | 0 | 0 | 0 | 1st month | 0 |
| Mean | 25,39 | 13,13 | 17,35 | 14,55 | 15,52 |
| Median | 24 | 12 | 16 | 14,5 | 15 |
| Std. Deviation | 8,201 | 7,899 | 6,139 | 3,661 | 3,86 |
| Minimum | 12 | 4 | 7 | 7 | 9 |
| Maximum | 40 | 33 | 30 | 23 | 24 |

Std: Standard, Preop: Preoperative

after trabeculectomy, the numerical decrease in IOP was more significant than the other groups but statistically was not significant. At the end of the third month, the mean IOP between the three groups approached each other.

Anti-glaucomatous drops were added in 9 patients (36%) within the first three months after trabeculectomy of 25 phakic eyes, and 16 (64%) of them were followed without medication. 2 (16.7%) of pseudophakic eyes that underwent

trabeculectomy were given an anti-glaucomatous drop. Medication was added to 10 (43.5%) patients who underwent phaco-trabeculectomy. It was found that there wasn't a statistically significant difference between the three groups (Table 4).

The BCVAs before surgery according to the established criteria (A, B, C) were 3 (27%), 3 (27%), 5 (45.5%) in pseudophakic patients, and 10 (%40), 5 (%20), 10 (%40)

Table 4: Antiglaucomatous drop necessary in the study groups.

| Groups | | Medication+ | Medication- | total |
|-----------------------------|--------------------|-------------|-------------|--------|
| Pseudophakic-Trabeculectomy | count | 2a | 9a | 11 |
| | % within operation | 18.2% | 81.8% | 100.0% |
| | % within postop | 9.5% | 23.7% | 18.6% |
| Phakic-Trabeculectomy | count | 9a | 16a | 25 |
| | % within operation | 36.0% | 64.0% | 100.0% |
| | % within postop | 42.9% | 42.1% | 42.4% |
| Phakic-Phacotrabeulectomy | count | 10a | 13a | 23 |
| | % within operation | 43.5% | 56.5% | 100.0% |
| | % within postop | 47.6% | 34.2% | 39.0% |
| Total | count | 21 | 38 | 59 |
| | % within operation | 35.6% | 64.4% | 100.0% |
| | % within postop | 100.0% | 100.0% | 100.0% |

Each subscript letter denotes a subset of post-medicine categories whose column proportion do not differ significantly from each other at the .05 level.

in phakic patients scheduled for trabeculectomy, 13 (%56.5), 4 (%17.4), 6 (%26.1) in patients who were phakic and planned for combined surgery, respectively (Table 5). A decrease in BCVA was observed in all groups on the first day after surgery. However, it was not statistically significant (Table 6). At the end of the third month, all groups reached the initial BCVA (Table 7, 8, 9). Although it was not statistically significant, a significant increase was observed in visual acuity, especially in patients who had undergone phaco-trabeculectomy.

DISCUSSION

The incidence of cataracts and glaucoma increases with advancing age. Although bleb failure is common

in trabeculectomies performed in combination with extracapsular cataract surgery, the success rate of combined surgeries has increased with today's developing surgical techniques.¹³

The mechanism of the decrease in IOP after cataract surgery is not identified completely yet. Mechanical effects such as an anatomical change in the iridocorneal angle and facilitation of outflow due to pseudophakia and decrease in aqueous production as a result of traction in the ciliary body after the lens anterior capsule and ligament contraction, the backward movement of the zonules with the traction in the ciliary body and, as a result, the relief of compression on the trabecular meshwork and Schlemm canal has been suggested.^{14,15}

Table 5: Preoperative visual acuities in the study groups

| Groups | | Visual Acuity preoperative | | |
|-----------------------------|--------------------|----------------------------|-----------|---------|
| | | 0.05> | 0.05-0.29 | 0.3< |
| Pseudophakic-Trabeculectomy | count | 3a | 3a | 5a |
| | % within operation | 27.3% | %27,30 | %45,50 |
| | % within postop | %11,50 | %25,00 | %23,80 |
| Phakic-Trabeculectomy | count | 10a | 5a | 10a |
| | % within operation | %40,00 | %20,00 | %40,00 |
| | % within postop | %38,50 | %41,70 | %47,60 |
| Phakic-Phacotrabeculectomy | count | 13a | 4a | 6a |
| | % within operation | %56,50 | %17,40 | %26,10 |
| | % within postop | %50,00 | %33,30 | %28,60 |
| Total | count | 26 | 12 | 21 |
| | % within operation | %44,10 | %20,30 | %35,60 |
| | % within postop | %100,00 | %100,00 | %100,00 |

Table 6: 1st-day visual acuities

| Groups | | Visual Acuity 1st day | | |
|-----------------------------|--------------------|-----------------------|-----------|---------|
| | | 0.05> | 0.05-0.29 | 0.3< |
| Pseudophakic-Trabeculectomy | count | 6a | 3a | 2a |
| | % within operation | %54,50 | %27,30 | %18,20 |
| | % within postop | %17,10 | %15,80 | %40,00 |
| Phakic-Trabeculectomy | count | 16a | 8a | 1a |
| | % within operation | %64,00 | %32,00 | %4,00 |
| | % within postop | %45,70 | %42,10 | %20,00 |
| Phakic-Phacotrabeculectomy | count | 13a | 8a | 2a |
| | % within operation | %56,50 | %34,80 | %8,70 |
| | % within postop | %37,10 | %42,10 | %40,00 |
| Total | count | 35 | 19 | 5 |
| | % within operation | %59,30 | %32,20 | %8,50 |
| | % within postop | %100,00 | %100,00 | %100,00 |

| | | Visual Acuity 1st week | | |
|-----------------------------|--------------------|------------------------|-----------|---------|
| Groups | | 0.05> | 0.05-0.29 | 0.3< |
| Pseudophakic-Trabeculectomy | count | 4a | 4a | 3a |
| | % within operation | %36,40 | %36,40 | %27,30 |
| | % within postop | %14,80 | %21,10 | %23,10 |
| Phakic-Trabeculectomy | count | 12a | 10a | 3a |
| | % within operation | %48,00 | %40,00 | %12,00 |
| | % within postop | %44,40 | %52,60 | %23,10 |
| Phakic-Phacotrabeculectomy | count | 11a | 5a | 7a |
| | % within operation | %47,80 | %21,70 | %30,40 |
| | % within postop | %40,70 | %26,30 | %53,80 |
| Total | count | 27.0 | 19 | 13 |
| | % within operation | %45,80 | %32,20 | %22,00 |
| | % within postop | %100,00 | %100,00 | %100,00 |

| | | Visual Acuity 1st month | | |
|-----------------------------|--------------------|-------------------------|-----------|---------|
| Groups | | 0.05> | 0.05-0.29 | 0.3< |
| Pseudophakic-Trabeculectomy | count | 3a | 3a | 5a |
| | % within operation | 27.3% | %27,30 | %45,50 |
| | % within postop | %12,50 | %25,00 | %21,70 |
| Phakic-Trabeculectomy | count | 11a | 5a | 9a |
| | % within operation | %44,00 | %20,00 | %36,00 |
| | % within postop | %45,80 | %41,70 | %39,10 |
| Phakic-Phacotrabeculectomy | count | 10a | 4a | 9a |
| | % within operation | %43,50 | %17,40 | %39,10 |
| | % within postop | %41,70 | %33,30 | %39,10 |
| Total | count | 24 | 12 | 23 |
| | % within operation | %40,70 | %20,30 | %39,00 |
| | % within postop | %100,00 | %100,00 | %100,00 |

| | | Visual Acuity 3rd month | | |
|-----------------------------|--------------------|-------------------------|-----------|---------|
| Groups | | 0.05> | 0.05-0.29 | 0.3< |
| Pseudophakic-Trabeculectomy | count | 2a | 4a | 5a |
| | % within operation | %18,20 | %36,40 | %45,50 |
| | % within postop | %9,50 | %28,60 | %20,80 |
| Phakic-Trabeculectomy | count | 10a | 6a | 9a |
| | % within operation | %40,00 | %24,00 | %36,00 |
| | % within postop | %47,60 | %42,90 | %37,50 |
| Phakic-Phacotrabeculectomy | count | 9a | 4a | 10a |
| | % within operation | %39,10 | %17,40 | %43,50 |
| | % within postop | %42,90 | %28,60 | %41,70 |
| Total | count | 21 | 14 | 24 |
| | % within operation | %35,60 | %23,70 | %40,70 |
| | % within postop | %100,00 | %100,00 | %100,00 |

In this study, the effects of phaco-trabeculectomy and trabeculectomy on IOP control and the effects of the phakic-pseudophakic state of the eye on IOP reduction were examined, but statistically, a significant difference wasn't observed between these groups. Similar to our study, Guggenbach et al. compared phaco-trabeculectomy and they reported that trabeculectomy showed no difference between the two groups in terms of IOP control at the end of a 1-year follow-up.¹⁶ Similarly, in the study of Graf et al., no significant difference was observed between the mean IOPs after phaco-trabeculectomy and trabeculectomy. However, the decrease in IOP in the trabeculectomy group was statistically significant compared to phaco-trabeculectomy.¹⁷ Some studies suggest trabeculectomy alone provides a greater IOP reduction than combined surgeries.^{18,19} Friedman et al. In a study in which 39 articles were analyzed, it was stated that trabeculectomy caused a decrease in IOP compared to phaco-trabeculectomy.²⁰ Kleinmann et al. in their study including 135 patients comparing phaco trabeculectomy and trabeculectomy, reported that a decrease in the trabeculectomy group was found to be statistically significant. It has been claimed that the statistically higher scoring of the preoperative IOP of the trabeculectomy group compared to the phaco-trabeculectomy group may affect this result.¹⁹ Since glaucoma surgery accelerates cataract formation, surgeons tend to prefer combined surgery, but the increased inflammation caused by phaco-trabeculectomy results in a higher rate of bleb failure and additional anti-glaucomatous drop necessary.²¹ Sacchi et al. reported that lower IOP was achieved in pseudophakia eyes and less need for bleb needling.¹⁸ In our study, the decrease in IOP was more pronounced in pseudophakic patients who underwent trabeculectomy compared to other groups; however, we would like to draw attention to the fact that a higher value in mean preoperative IOP affects this result.

At the end of the third month, no statistically significant difference was found between the need for anti-glaucomatous medication between patients with phaco-trabeculectomy and phakic and pseudophakic patients with trabeculectomy. However, the need for additional anti-glaucomatous was higher in the group undergoing combined surgery. We thought that the reason for this was the increased inflammation resulting from phaco-trabeculectomy leading to bleb failure.

Although BCVA was higher in the phaco-trabeculectomy group compared to the preoperative period, as expected, it was not statistically significant; Song et al. reported that the visual acuity results were found to be similar between

the trabeculectomy group and the phaco-trabeculectomy group at the end of 12 months.²²

Due to the different inclusion criteria in the studies, it is not correct to compare them with each other. The use of anti-fibrotic agents, the stage of glaucoma, the age and comorbidities of the patients, the presence of the intraocular lens, and previous intraocular surgery may affect the success of glaucoma surgery.

The limited number of people, not determining the glaucoma type, and not staging the glaucoma are the limiting factors of this study.

CONCLUSION

In conclusion, the reducing effects of phaco-trabeculectomy and trabeculectomy on IOP reduction are similar. There is a need for larger-scale studies on the effect of cataract surgery on bleb functions.

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Conflicts of interest

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