Two-site phacotrabeculectomy versus bimanual microincision cataract surgery combined with trabeculectomy

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PURPOSE. *To compare the results of two-site phacotrabeculectomy with microincision cataract surgery (MICS) and trabeculectomy.*
METHODS. *Fifty-eight eyes with coexisting cataract and glaucoma were randomly assigned to have a trabeculectomy in a superior quadrant combined with phacoemulsification and intraocular lens (IOL) implantation through temporal clear corneal incision (two-site phacotrabeculectomy group), or a trabeculectomy in a superior quadrant combined with MICS followed by IOL implantation from the trabeculectomy incision (MICS + trabeculectomy group). The main outcome measures were preoperative and postoperative intraocular pressure (IOP), number of glaucoma medications, best-corrected visual acuity (BCVA), and complications. Follow-up was period was 12 months.*
RESULTS. *Twenty-eight two-site phacotrabeculectomies and 30 MICS + trabeculectomies were performed. Mean age of the subjects was 67.4 years. Mean preoperative IOP was 24.6±5.7 mmHg in the two-site phacotrabeculectomy group and 23.7±5.5 mmHg in the MICS + trabeculectomy group (p=0.52). At 12 months postoperatively mean IOP was 14.5±3.0 and 14.3±3.4 mmHg in two-site phacotrabeculectomy and MICS + trabeculectomy groups, respectively (p=0.8). Preoperative and postoperative glaucoma medication numbers were similar and mean number of glaucoma medications decreased in both groups after the surgery (p<0.05). BCVA improved in both groups. Twenty-six of 28 eyes (92%) in the two-site + trabeculectomy group and 27 of 30 (90%) in the MICS + trabeculectomy group had clinically apparent filtering blebs at 12 months (p=0.71). Postoperative complications were comparable.*
CONCLUSIONS. *MICS + trabeculectomy provided 1 year IOP control comparable to that with two-site phacotrabeculectomy with similar amount of complications and similar final BCVA. (Eur J Ophthalmol 2009; 19: 46-54)*

KEY WORDS. *Combined surgery, Phacotrabeculectomy, Microincision cataract surgery*

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INTRODUCTION

Combined cataract extraction, intraocular lens (IOL) implantation, and trabeculectomy is now widely accepted for management of eyes with coexistent cataract and glaucoma (1-3). One of the commonly used techniques is to perform a phacoemulsification through a temporal corneal incision and to perform trabeculectomy at the superior limbus (two-site technique). In the other technique, after creating a scleral tunnel and converting the tunnel to a scleral flap, a limbal fistula is created under it (single-site technique). Prospective studies, comparing these two approaches, have shown that patients in the two-site group had 1 to 2 mmHg more intraocular pressure (IOP) reduction

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and required less postoperative medications (4-6), although the differences were not statistically significant.

Microincision bimanual phacoemulsification or microincision cataract surgery (MICS) is a recently introduced technique that permits phacoemulsification through clear corneal wounds smaller than 1.5 mm (7-9). This technique uses sleeveless phaco tip and irrigation is provided through an irrigating chopper instead of through the phacoemulsification handpiece. Clinical studies have been positive, emphasizing the efficacy and safety of MICS on any of the currently available phaco systems (10-12). This technique can be combined with trabeculectomy (13, 14). During MICS + trabeculectomy, IOL is implanted through the trabeculectomy site, so there is no need for a larger corneal wound or a microincision IOL. Furthermore, the trabeculectomy fistula is not traumatized by phaco energy, which is an important issue for the success of filtration surgery.

Although the outcomes of MICS have been reported by many authors, no studies have compared the operative and postoperative outcomes of MICS + trabeculectomy and the traditional approach, two-site phacotrabeculectomy. The aim of this study is to compare these two techniques in regards to IOP reduction, visual acuity improvement, and safety.

METHODS

Surgery was indicated by poorly controlled IOP with maximum use of tolerated medications and the presence of a visually significant cataract. Patients were informed of the risks, benefits, and alternatives of surgery, and informed consent was obtained. Prior approval from the ethics committee of Gulhane Medical School Hospital was obtained. Inclusion criteria included 1) age range between 50 and 85 years; 2) diagnosis of glaucoma confirmed by the presence of glaucomatous disc cupping and/or glaucomatous visual field defect requiring medication(s) to control the IOP; 3) coexisting visually significant cataract; and 4) pupil dilation at the preoperative examination of at least 7 mm. Exclusion criteria included 1) single eye; 2) history of previous intraocular surgery (including laser trabeculoplasty); 3) posterior segment disorders; 4) cataracts that could not be safely removed by phacoemulsification; 5) presence of posterior synechia; and 6) mental instability.

Fifty-eight eyes with coexisting cataract and glaucoma were randomly assigned to have two-site phacotrabeculectomy or MICS + trabeculectomy. Randomization of the patients was achieved by asking them to choose any number between 1 and 10; even and odd numbers were assigned to two-site phacotrabeculectomy and MICS + trabeculectomy groups, respectively. Data including patient age, gender, preoperative IOP, preoperative best-corrected visual acuity (BCVA), preoperative ocular medication number (combination eye drops were counted as two medications), and vertical cup-to-disk ratio were recorded.

Each surgery was performed by the same surgeon (A.B.), using one of the two techniques. Local anesthesia was achieved with posterior sub-Tenon anesthesia. Fornix-based conjunctival flap was prepared and 0.2 mg/mL solution of mitomycin C (MMC) was applied for 2 minutes under the Tenon capsule. MMC was not applied in cases where the conjunctiva or Tenon capsule, or both, was thin. A limbus-based, 4 × 3 mm rectangular, half-thickness scleral flap was then dissected.

During two-site phacotrabeculectomy, phacoemulsification was performed through temporal corneal incision using AMO Sovereign phaco device, and hydrophobic acrylic lens (Sensar AR40e, AMO, Santa Ana, CA) was implanted into the capsular bag. Trabeculectomy opening (2 × 2 mm) was made using a Kelly Descemet's punch (Bausch & Lomb Surgical). This was followed by peripheral iridectomy. Scleral flap was closed with two to five 10-0 nylon sutures. The conjunctiva was sutured using interrupted 10-0 nylon sutures.

For the MICS + trabeculectomy group, a 19-G microvitreoretinal keratome was used to create two clear corneal incisions at the 10 o'clock and 2 o'clock positions. A bent 27-G needle was used to perform capsulorhexis. An Agarwall irrigation chopper (20-G or 0.9 mm outer diameter, 0.7 mm bore, 65 cc/min flow rate Duckworth & Kenat Ltd.) was inserted via the 2 o'clock port and then a sleeveless 20-G phaco tip was inserted through the 10 o'clock port. Bimanual phacoemulsification was then performed with the Whitestar Sovereign phacoemulsification system (AMO, Santa Ana, CA). Instrumental cortex removal was carried out. A 3.2 mm keratome was used to enter the anterior chamber (AC) under scleral flap. A foldable hydrophobic acrylic lens (Sensar AR40e, AMO, Santa Ana, CA) was inserted into the capsular bag through this incision. The surgical procedure was completed following the steps outlined in the two-site phacotrabeculectomy procedure.

Surgical parameters used in the study are shown in Table I.

Postoperatively, all the patients were started with prednisolone acetate 1% drops every 2 hours while awake and ofloxacin 0.3% four times daily for the first week. The frequency of administration of the steroids was gradually decreased with time, according to the postoperative wound healing reaction. Postoperative manipulations were undertaken, including the laser suture lysis, massaging the bleb, and bleb needling when needed.

The follow-up of patients was as follows: day 1, weekly from week 1 to 4, week 6, and months 2, 4, 6, and 12. These assessments could be varied according to clinical indications.

The surgical outcome measures were total phacoemulsification percent and effective phacoemulsification time (EPT) (calculated by multiplying total phacoemulsification time in seconds by the average power percent used). Postoperative outcome measures were mean postoperative IOP, mean IOP drop from baseline, mean number of glaucoma medications, BCVA, number of intraoperative MMC use, intra- and postoperative complications, postoperative suture lysis, and bleb needling. Bleb morphology was evaluated using slit-lamp. The presence of cells and flare in the anterior chamber was assessed at the slit lamp with ×16 magnification and a 1.0 mm × 3.0 mm light ray (15). Funduscopic examination was performed.

Absolute success was defined as an IOP equal to or less than 16 mmHg without medication. Relative success was defined as an IOP equal to or less than 20 mmHg with or without medication. Postoperative hypotony was defined as an IOP <5 mmHg on two consecutive days. IOP spike was defined as an IOP >25 mmHg on postoperative day 1. Treatment failure was said to have occurred if needling was performed.

Kaplan-Meier survival analysis was used to determine the probabilities of absolute and relative surgical success and the survival curves were compared using the log rank test. Two-sided unpaired Student *t* test was used to compare the groups on continuous variables. Progress in the follow-up period was evaluated using the analysis of variance (ANOVA). When appropriate the chi-square test was used to compare proportions between the two groups. A p value of 0.05 or less was considered significant.

RESULTS

Twenty-eight two-site phacotrabeculectomy and 30 MICS + trabeculectomy operations were performed between September 2004 and January 2006. Although IOP was less than 21 mmHg, two eyes from the two-site group and three eyes from the MICS + trabeculectomy group had surgery because of advanced glaucomatous damage that required further IOP reduction. Patient characteristics are shown in Table II. There were no significant between-group differences in any characteristic (p>0.05).

There was no statistically significant difference preoperatively between the two groups with respect to BCVA (p=0.29), IOP (p=0.52), or glaucoma medication numbers (p=0.34).

Statistically significant differences were found between two-site phacotrabeculectomy and MICS + trabeculectomy groups regarding mean total phacoemulsification percent and the mean EPT (p=0.001) (Tab. II). Intraoperative complications included zonular dehiscence requiring capsule tension ring implantation in one case in the two-site phacoemulsification group and conjunctival buttonhole formation that was repaired with U suture in one case in the MICS + trabeculectomy group. Number of sutures used for scleral flap closure were 4.18±0.61 and 4.23±0.57 for the two-site phacotrabeculectomy and MICS + trabeculectomy groups, respectively, and was similar between the groups (p=0.73).

The number of eyes that received intraoperative MMC was similar between the groups (p=0.36).

Postoperative laser suture lysis was required in seven eyes in the two-site phacotrabeculectomy group and four eyes in the MICS + trabeculectomy group (p=0.26). The number of eyes that received bleb needling was also similar between the groups (p=0.51).

The majority of patients had a postoperative visual acuity improvement (85% and 86% in the two-site phacotra-

TABLE I - SURGICAL PARAMETERS USED IN THE STUDY

Parameter	Two-site phacotrabeculectomy (n=28)	MICS + trabeculectomy (n=30)
Power	20–50%	20–30%
Aspiration flow, cm^3/min	25	18–36
Vacuum, mmHg		
Unoccluded	60–250	60–250
Occluded	80–300	80–300
Irrigation/aspiration of the cortical remnants, mmHg	450	450
Bottle height, cm	65	100

beculectomy and MICS + trabeculectomy groups, respectively). No statistically significant differences were found between the groups regarding mean BCVA on the 12th month (p=0.88).

Postoperative AC reaction was similar between the groups (p>0.05).

The mean number of antiglaucoma medications at 12 months was 0.67±0.26 in the two-site phacotrabeculectomy and 0.6 ± 0.72 in the MICS + trabeculectomy group (p=0.71). There was a significant difference between the preoperative and postoperative glaucoma medication numbers for both groups (p<0.001). The reduction in the mean number of glaucoma medications at the end of the follow-up period was not significantly different between the groups (p=0.36).

The preoperative and postoperative IOPs and mean reduction values in both groups are shown in Table III. Mean IOP initially decreased significantly in both the groups and then stabilized between 13.0±4.4 and 14.4±3.2 mmHg during the 12 months of follow-up (p=0.0001, ANOVA; Fig. 1). Kaplan-Meier survival curves show a similar trend among the two groups throughout the 12 months of follow-up, with the majority of failures occurring within the first 3 to 6 postoperative months (Fig. 2). There was no statistically significant difference in success rates between the two groups at 12 months in the two categories assessed (p>0.05).

In the two-site phacotrabeculectomy group, 19, 7, and 2 eyes had normal diffuse translucent, cystic, and vascularized blebs, respectively. In the MICS + trabeculectomy

TABLE II - PATIENT CHARACTERISTICS AND SURGICAL OUTCOME

Characteristic	Two-site phacotrabeculectomy (n=28)	MICS + trabeculectomy (n=30)	p value
Age, yr, mean ± SD	67.0±6.1	67.9±6.7	0.61
Subtypes of glaucoma			0.49
Primary open angle	18	22	
Pseudoexfoliation	8	5	
Chronic angle closure	1	2	
Pigmentary	1	–	
Steroid induced	–	1	
Sex, F/M	13/15	17/13	0.59
Cup-to-disk ratio, mean ± SD	0.69±0.15	0.65±0.19	0.39
Preoperative medication number, mean ± SD	2.36±0.83	2.57±0.82	0.34
Preoperative BCVA, mean ± SD	0.41±0.19	0.45±0.13	0.29
Diabetes mellitus	8 (29%)	7 (23%)	0.64
Intraoperative surgical parameters			
Mean total phacoemulsification (%), mean ± SD	7.9±10.87	5.35±4.01	0.001
Mean effective phacoemulsification time, mean ± SD	6.1±8.2	3.37±2.8	0.001
MMC use (%)	23/28	21/30	0.36
Postoperative laser suture lysis	7/28	4/30	0.26
Postoperative outcome measures			
Bleb needling	1/28	2/30	0.51
Postoperative BCVA, mean ± SD			
Day 1	0.59±0.29	0.67±0.28	0.29
Day 7	0.63±0.27	0.69±0.24	0.38
Month 1	0.68±0.25	0.69±0.23	0.79
Month 12	0.68±0.26	0.69±0.24	0.88
Postoperative flare/cells in AC, mean ± SD	0.89±0.83	0.77±0.85	0.57
Day 1	0.32±0.48	0.33±0.47	0.93
Day 7	0.07±0.26	0.07±0.25	0.94
Month 1			
Postoperative medication number, mean ± SD	0.67±0.26	0.6±0.72	0.71
Reduction of IOP, mm Hg, mean ± SD	10.14±6.35 (37%)	9.4±6.45 (36%)	0.66

Best-corrected visual acuity (BCVA) expressed in decimals on a 10/10 = 1 scale basis (1/10 = 0.1, 2/10 = 0.2, etcetera).
AC = anterior chamber; IOP = intraocular pressure; MMC = mitomycin C; SD = standard deviation.

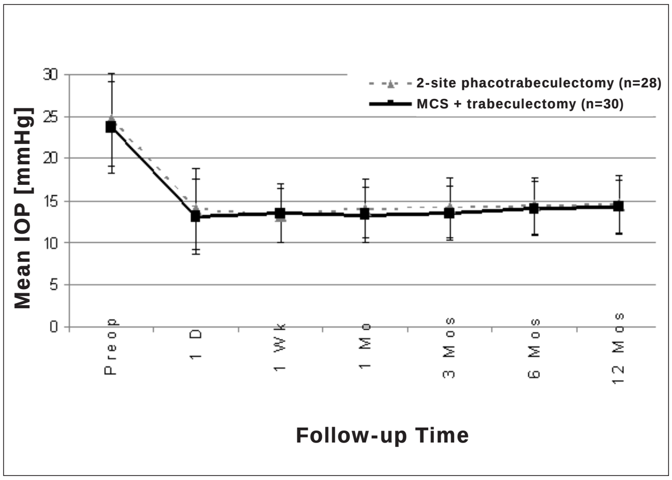

Fig. 1 - *Graph representing the change in intraocular pressure in mmHg following the surgery. The error bars represent 95% confidence intervals.*

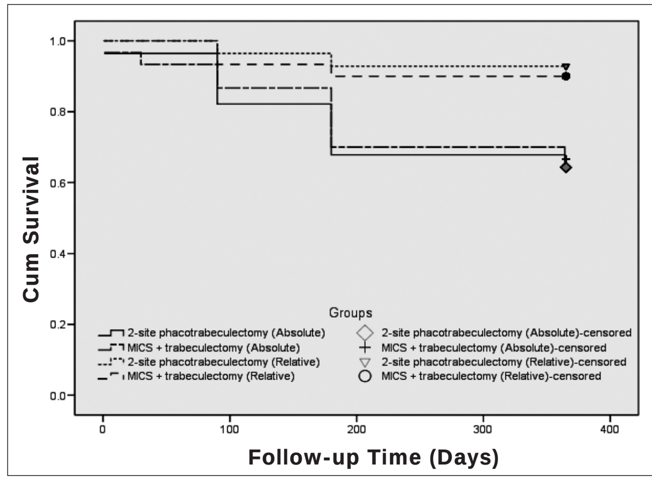

Fig. 2 - *The Kaplan-Meier survival analysis for the two groups with success criteria defined as absolute or relative surgical success. Using a log-rank test, these success rates were not significantly different between the groups (p>0.05).*

TABLE III - PREOPERATIVE AND POSTOPERATIVE MEAN IOP (mmHg)

Period	Two-site phacotrabeculectomy n=28)	MICS + trabeculectomy (n=30)	p value*
Preoperative	24.6±5.7 (12–32)	23.7±5.5 (14–35)	0.52
Postoperative			
1 day	13.9±4.4 (6–24)	13.0±4.4 (6–23)	0.46
1 week	13.2±3.5 (5–21)	13.4±3.2 (8–20)	0.77
1 month	13.9±3.3 (9–22)	13.2±3.5 (10–21)	0.44
3 months	14.1±3.3 (8–22)	13.4±3.5 (10–23)	0.43
6 months	14.4±3.2 (8–21)	13.9±3.3 (9–22)	0.62
12 months	14.5±3.0 (9–22)	14.3±3.4 (9–21)	0.82
p Value†	0.001	0.001	—

Values are intraocular pressure (IOP) mean ± SD (range).
*Compares the two groups at each time measurement.
†Analysis of variance used to compare mean IOP in the same group over the follow-up.

TABLE IV - POSTOPERATIVE COMPLICATIONS

Complication	Two-site phacotrabeculectomy (n=28)	MICS + trabeculectomy (n=30)	p value
Transient hypotony	2 (7)	3 (10)	0.69
Hyphema	2 (7)	2 (6.7)	0.94
Corneal edema	3 (11)	1 (3.3)	0.27
Conjunctival wound leak	—	1 (3.3)	0.33
Shallow anterior chamber	1 (3.6)	—	0.30
IOP spike	1 (3.6)	1 (3.3)	0.96

Values are n (%) of eyes.
IOP = intraocular pressure.

group, 22, 5, and 3 eyes had normal, cystic, and vascularized blebs, respectively (p=0.71).
Postoperative complications were also comparable. The most commonly recorded postoperative complications in both groups were early hypotony and early hyphema and these rates were fairly similar (p=0.69 and p=0.96). The two-site phacotrabeculectomy group showed a slightly higher incidence of early corneal edema. All other complications were observed with similar frequencies in both groups (Tab. IV). None of the eyes developed excessive postoperative anterior chamber inflammatory cellular reaction or fibrin formation requiring more than the usual dose of steroids.

DISCUSSION

Our results suggest that there is no significant difference in final visual acuity, IOP control, and glaucoma medication requirements between two-site phacotrabeculectomy and MICS + trabeculectomy.
It can be claimed that the two procedures used in our study are both two-site procedures and it could be better to compare single-site phacotrabeculectomy to MICS + trabeculectomy. We preferred two-site phacotrabeculectomy as the superiority of this technique over single-site phacotrabeculectomy has already been shown by many authors (4-6).
Weitzman and Caprioli first described the two-site phacotrabeculectomy technique (16). They postulated that it has the potential advantage of reducing manipulation of both the conjunctiva and scleral flaps to the level of that in a standard trabeculectomy, which may help achieve long-term IOP control. The technique of combining MICS with trabeculectomy and insertion of a foldable IOL through the trabeculectomy fistula is recently incorporated and has been reported as a feasible and valuable technique for cases with combined cataract and glaucoma (13, 14).
One main factor in the success of combined cataract and glaucoma surgery is the control of the inflammatory response caused by surgery. Combined surgery involving phacoemulsification and trabeculectomy has a reduced success rate compared to trabeculectomy alone (17). Although the mechanisms that would explain this difference was not clarified, this may be related to breakdown of the blood–aqueous barrier that accompanies phacoemulsification and the release of inflammatory mediators leading to reduced bleb function (18). Therefore it is necessary to look for a technique that reduces surgical trauma during combined surgery (2). MICS is a technique that has been reported to cause less inflammation. This may be a significant advantage when combined with a trabeculectomy (19). A reduction in postoperative inflammation is likely to reduce the risk of fibrosis and filter failure. During MICS + trabeculectomy, IOL is implanted through the trabeculectomy site. Furthermore, the trabeculectomy fistula is not traumatized by phaco energy. Thus, MICS + trabeculectomy has been reported to combine the advantages of the conventional one-site and two-site phacotrabeculectomy (14). In our study, there were no significant differences between the two techniques in regards to postoperative anterior chamber reaction.
Total ultrasonic energy is one main factor during cataract or combined surgery. Because of new systems, MICS techniques have been reported to reduce considerably the amount of energy used, and the phacoemulsification needle does not increase the temperature (2, 12). Actual data show that conventional phacoemulsification obtains 3 to 6 seconds of EPT compared with the MICS technique, which obtains a mean EPT about 3 seconds (12, 20). This was similar in our study. Mean total phacoemulsification percentage and mean EPT values were significantly lower in the MICS + trabeculectomy group when compared with the two-site phacotrabeculectomy group. In our patients, there was no case with wound burns. According to Paul and Braga-Mele, Whitestar prevents temperature elevation by using microbursts of phacoemulsification energy. During the off-cycle of the phaco energy bursts, the heat generated in the previous cycle has an opportunity to dissipate (7). During MICS, the nuclei were sectioned into small pieces and we tried to use ultrasound primarily during aspiration as was reported by Olson (19), thus minimal power settings were used.
Preoperative mean IOP was comparable in both groups. Although the postoperative mean IOP was usually lower in the MICS + trabeculectomy group during the follow-up, this was not statistically significant. In addition, preoperative IOP was also lower in the MICS + trabeculectomy group and the percentage of reduction at the end of our follow-up period was similar between the groups. At 12 months, mean IOP was significantly decreased in both groups (37.1% and 36.2% in two-site phacotrabeculectomy and MICS + trabeculectomy groups, respectively) with similar number of glaucoma medications. Reduction in IOP was similar to previous reports. el Sayyad et al re-

ported a 37.3% reduction in IOP at 1 year postoperatively in eyes with two-site phacotrabeculectomy + MMC (21). Kozobolis et al obtained a 30.6% reduction in IOP with the same procedure after a 1-year follow-up (22). Similar result was obtained by Kleinmann et al (23). However, there are only two studies which investigate the outcomes of MICS + trabeculectomy. In one of these studies, Tham et al reported a 41.1% reduction in IOP at 6 months postoperatively (14). Dada et al reported an IOP value of 13.2±2.4 mmHg at 12 weeks (13). This value was also very close to our mean IOP at third month (13.4±3.5 mmHg). Therefore we suggest that both two-site phacotrabeculectomy and MICS + trabeculectomy options were equally effective in reduction of IOP.

In terms of surgical success, using the criteria that we set, outcomes were similar between the groups. The criteria for success were chosen for the following reasons: older studies have used an IOP of <20 mmHg as an acceptable target for successful filtration surgery. More recent studies have suggested that aiming for an even lower target IOP is preferable for some patients and consequently have used an IOP of <16 or 17 mmHg as a more desirable outcome measure (24, 25). The relative success rate as defined as an IOP equal to or less than 20 mmHg with or without glaucoma drops was 92.9% for the two-site phacotrabeculectomy group, and 90% for the MICS + trabeculectomy group after 12 months (p=0.69). The absolute success rate as defined as an IOP equal to or less than 16 mmHg without medication was 64.3% and 633% for two-site phacotrabeculectomy and MICS + trabeculectomy groups, respectively (p=0.94). Our results comparable to those of Lyle and Jin (26), Munden and Alward (27), and Lochhead et al (28), although they all used the single site technique. There is no prospective long-term study investigating the success rate of MICS + trabeculectomy so far, but 90% and 100% of cases had IOP values of less than 17 mmHg without medication in two articles after 6 and 3 months of follow-up, respectively (13, 14). It is not ideal to compare the success rates of these two articles with ours since the follow-up periods were too short and the number of cases was too small in these studies (5 and 10 cases, respectively).

The literature supports phacotrabeculectomy as an effective procedure in terms of visual improvement (22, 29, 30). In our study, there was marked improvement in visual acuity in both groups postoperatively. During the early postoperative period, mean BCVA was slightly better in the MICS + trabeculectomy group. This difference may be due to early corneal edema observed in the two-site phacotrabeculectomy group. Mean BCVA values were very close between the groups after 1 month. We did not find any statistically significant difference between the two techniques in postoperative BCVA. Therefore, we conclude that the two techniques are equally valid as postoperative visual rehabilitation was quick and satisfactory in both groups.

Although we did not evaluate this in our study, one other possible different outcome of two-site phacotrabeculectomy and MICS + trabeculectomy techniques may be surgically induced astigmatism, which has been reported to be higher in cases with standard phacoemulsification when compared with MICS (9).

The complication rates for these two procedures were found to be similar. Early hypotony was the most common postoperative complication in both groups and was improved spontaneously. Hyphema was the second most common complication and was also resolved spontaneously. Although nonsignificant, early corneal edema was more common in the two-site phacotrabeculectomy group. One of the possible explanations may be that MICS has less chamber fluid leakage, and turbulence is therefore reduced in comparison with the conventional technique, resulting in less endothelial cell loss and lower postoperative corneal edema. However, Alio et al reported that endothelial cell loss is similar between MICS and coaxial phacoemulsification (9). One other complication, conjunctival leak, was observed in only one case from the MICS + trabeculectomy group and was treated with a plano T lens.

Some of our cases had pseudoexfoliation. One of the cases with pseudoexfoliation from the two-site phacotrabeculectomy group had zonular dehiscence during surgery and was repaired with capsule tension ring. Pseudoexfoliative glaucoma patients have weak zonula, and more precise and careful maneuvers should be used to prevent dehiscence. Capsulorhexis through 1 to 1.5 mm incisions in the MICS + trabeculectomy group allowed a better close anterior chamber, maintaining the viscoelastic in place, keeping a wide anterior chamber, and flattening the anterior curve of the lens. This facilitated a preferred wide capsulorhexis, as should be done in these cases to prevent retraction over time.

There are several advantages of the MICS + trabeculectomy method. One of these is that the surgeon can remain seated at the 12 o'clock position throughout the surgery without having to change his or her seating position, as in

conventional two-site phacotrabeculectomy (14). Smaller incisions theoretically prevent high-pressure fluctuation within the eye during the surgery and prevent the loss of viscoelasticity, and hence provide a more stable anterior chamber during the procedure. The separate aspirating and irrigating handpiece ports can be interchanged, giving the surgeon a number of approaches to reach nuclear or cortical fragments subincisionally. We were more comfortable while performing early postoperative procedures such as digital ocular compression or massage (21, 31) and Traverso maneuver (32) in cases with MICS + trabeculectomy since the corneal incisions were smaller. Both procedures are risky in early period after two-site phacotrabeculectomy because of the corneal wound. Finally, small corneal incisions heal quickly, and are theoretically associated with reduced risk of endophthalmitis.
MICS technique has some disadvantages also. Small size of the irrigating probes limits the maximum irrigation that can be provided to the eye causing surge under high vacuum conditions. Also, the surgeon should be careful not to inject too much BSS during the hydrodissection/hydrodelineation via an ultrasmall incision as this may increase possibility of capsule block syndrome, especially with use of high-density ocular viscoelastic devices.
The study had some shortcomings. The validity of the conclusions of this study is limited by the small sample size. We included the cases with pupil dilation at the preoperative examination of at least 7 mm. Since the sleeveless phaco tip may be in contact with the iris tissue in patients with small pupils, iris tissue may be affected during MICS in these cases. All of the patients included in the study were elderly (mean age 67.4 years) and white. It is important therefore to appreciate that these results are not necessarily applicable to younger individuals or to other ethnic groups.
The results of this study suggest that two-site phacotrabeculectomy and MICS + trabeculectomy may be equally safe and effective up to 12 months of follow-up. Future prospective randomized studies are needed to validate the routine use of MICS + trabeculectomy in patients with both glaucoma and cataract.

The authors have no financial interest in any of the products used in this study.

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