The Egyptian Journal of Hospital Medicine (April 2019) Vol. 75 (6), Page 3148-3162

One-Site Versus Two-Site Phacotrabeculectomy

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ABSTRACT

Background: surgical treatment for patients with concurrent glaucoma and cataract includes sequential surgery and combined phacotrabeculectomy**.** When combined surgery is planned, the next issue that must to deal with is whether two-site surgery is better or one-site surgery. **Aim:** the study aimed to compare the outcomes and to report on the efficacy and safety of the two procedures.

Patients and Methods: this prospective randomized comparative interventional study included fifty subjects. Patients were recruited from those who attended to the outpatient Ophthalmology Clinic of Sayed Galal hospital, Al-Azhar University. The study was conducted in the period from October 2016 until May 2018. Patients were randomized into two groups: Group I (n=25), who was subjected to one-site phacotrabeculectomy and Group II (n=25), who was subjected to the two-site procedure performed by one experienced anterior segment surgeon.

Results: no significant differences were observed in the main outcome measures of IOP and the need for supplemental antiglaucoma medications between the two glaucoma groups.

Conclusion: both surgical techniques were effective in reducing IOP and to eliminate the need for antiglaucoma medications in many eyes over the entire study period.

Keywords: phacotrabeculectomy, glaucoma, cataract.

INTRODUCTION

Cataract and glaucoma are frequently coexisting ocular conditions in the elderly population. Recently, as the surgical techniques used to treat both cataracts and glaucoma have advanced, there has been an increased number of reports in the literature regarding the optimal management of these conditions [(1)].

Treatment for patients with concurrent cataract and glaucoma includes sequential surgery and combined phacotrabeculectomy [(2)].

The increased risk of cataract development in some glaucoma patients the significantly increased risk of cataract development after glaucoma surgery and the need to minimize both trauma and cost induced by two separate surgical procedures, has made combined cataract and glaucoma surgery an appealing therapeutic approach[(3)].

Combined phacotrabeculectomy has its advantages. First, it reduces risks of additional intra-ocular surgeries, because frequently after trabeculectomy, there is rapid progression of lens opacities into visually significant cataracts that require cataract surgery. Secondly, sequential cataract surgery is associated with increased risk of trabeculectomy failure which may be minimized by combined phacotrabeculectomy [(4)].

AIM OF THE WORK

In this prospective randomized interventional study, our purpose was to compare the outcomes of one-site versus two-site combined phacoemulsification with a foldable intraocular lens (IOL) implantation and trabeculectomy and to report on the efficacy and safety of the two procedures.

PATIENTS AND METHODS

Fifty eight eyes of 48 patients who met the inclusion criteria were included in the study. Patients were randomized into two groups: Group I (n=29 eyes of 25 patients), who was subjected to one-site phacotrabeculectomy and Group II (n=29 eyes of 23 patients), who was subjected to the two-site procedure performed by the author.

Eight eyes of 6 patients were excluded from analysis because of loss at the follow-up (4 eyes of 2 patients from group I and 2 eyes of 2 patients from group II) and due to phaco related complications (2 eyes of 2 patients from group II). Therefore, we report on the findings of the remaining 50 eyes of 42 patients.

Approval Consideration:

Written informed consent was obtained from all patients before proceeding with surgery, and after explanation of the nature of the procedure and the possible complications. The study protocol, patient information sheet, and consent form were approved by the Ethics Board of Al-Azhar University.

Inclusion criteria were:

- Visually and Functionally Significant Cataract: Cataract surgery was indicated in patients who has cataract as the main cause of a noticeable decrease in vision and interferes with a person's ability to perform necessary or desired tasks. Grading of nuclear density was done according to Lens Opacity Classification System ＩＩＩ (LOCS III).
- Primary Open Angle Glaucoma: Glaucoma surgery was indicated in patients who fail to respond to maximally tolerated medical therapy or who

Received:15/9/2018
Accepted:30/9/2018

continue to have progressive optic nerve damage in spite of medical control.

Exclusion criteria were:

- Presence of lens subluxation.
- Secondary glaucoma as neovascular, uvitic and traumatic glaucoma.
- Angle closure glaucoma.
- Presence of any other ocular pathology (apart from cataract) that may reduce visual acuity.
- History of previous intraocular surgery.

Preoperative evaluations:

- Determination of the best corrected visual acuity (BCVA) using logMAR notation.
- Slit-lamp examination to evaluate the type and extent of cataract. Grading of nuclear density was done according to Lens Opacity Classification System I I I (LOCS III).
- Intraocular pressure (IOP) measurement using Goldmann applanation tonometry.
- Gonioscopy: using Goldmann 3-mirrors goniolens to evaluate the angle and ensure that glaucoma is of the primary open type.
- The posterior segment was evaluated indirectly using 90 D lens and the optic nerve status was noted in all eyes, evidence of coexisting macular or retinal pathology that may be playing a role in diminution of visual acuity.
- Keratometry and refractive error were measured using Topcon auto-refracto-keratometer.
- Biometry was done with IOL master (ALADDIN Topcon Japan).
- Data were collected on all glaucoma medications (topical and systemic), previous laser and surgical treatment for glaucoma.

Surgical procedure in Group I

The following technique was utilized for the one-site phacotrabeculectomy (Group I):

All patients were operated under peribulbar anesthesia.

A fornix-based conjunctival flap in the superior conjunctival quadrant was fashioned and the sclera was treated with light surface cautery.

Creation of 2 partial thickness scleral incisions 2mm long; perpendicular to limbus and 4mm separated from each other, and then creation of a horizontal incision connecting the distal ends of the longitudinal incisions. Then rectangular partial-thickness scleral flap was made with a cescent knife at the 12 o'clock position. Application of sponges soaked in mitomycin c 0.4% in the sub-conjunctival pocket for 2 minutes, then sponges were removed and profuse flushing with balanced saline solution was done to washout any residual of mitomycin c.

Phacoemulsification

Side ports were made and viscoelastic injected into the anterior chamber. A keratome 2.8 mm was used to make a limbal incision underneath the scleral flap at the anterior limbus.

Five mm wide continuous curvilinear capsulorrhexis (CCC) was done. In cases with poor anterior capsule visualization trypan blue was greatly useful in safely completing the capsulorrhexis.

Lens nucleus was removed by phacoemulsification. Remaining cortex was removed with bimanual irrigation and aspiration, followed by intraocular lens implant (IOL) placement in the bag.

A trabeculectomy was then performed with a knife and Vannas scissors, followed by a peripheral iridectomy.

Scleral flap closure was done with two 10-0 nylon sutures after adjustment to achieve slow steady egress of aqueous underneath the scleral flap with maintenance of stable AC depth and normal IOP. Then conjunctival flap closure was done with a mattress-type 8-0 polyglycolic acid suture.

Stromal corneal hydration was used to achieve watertight closure of paracenteses. The AC was deepened through paracentesis with good bleb elevation and no bleb leakage

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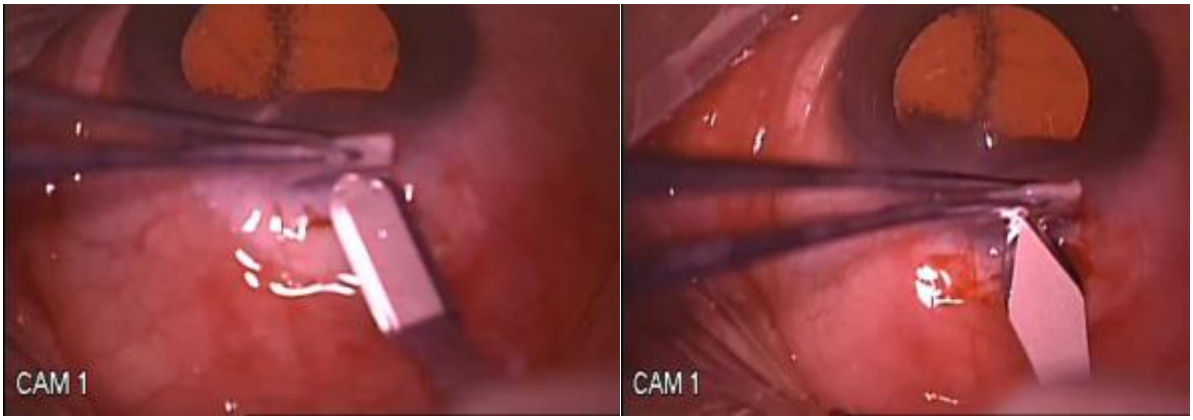

A **B**

Figure 1.A- Rectangular partial-thickness scleral flap. **B-** Limbal incision underneath the scleral flap

Surgical

Procedure in Group II

The following technique was utilized for the two-site phacotrabeculectomy Group II.

All patients were operated under peribulbar anesthesia. A fornix-based conjunctival flap in the superior conjunctival quadrant was fashioned and the sclera was treated with light surface cautery for adequate hemostasis.

Rectangular partial-thickness scleral flap was made with a cescent knife or blade 15 at the 12 o'clock position and application mitomycin c 0.4% as in Group I.

Phacoemulsification

Side ports were made and viscoelastic injected into the anterior chamber. A diamond keratome 2.8 mm was used to make a clear corneal separate incision

Five mm wide continuous curvilinear capsulorrhexis (CCC) was done. Lens nucleus was removed by phacoemulsification. Remaining cortex was removed with bimanual irrigation and aspiration, followed by IOL placement in the bag.

A trabeculectomy was then performed with a knife and Vannas scissors, followed by a peripheral iridectomy.

Scleral flap closure was done with two 10-0 nylon sutures and conjunctival flap closure was done with a mattress-type 8-0 polyglycolic acid suture.

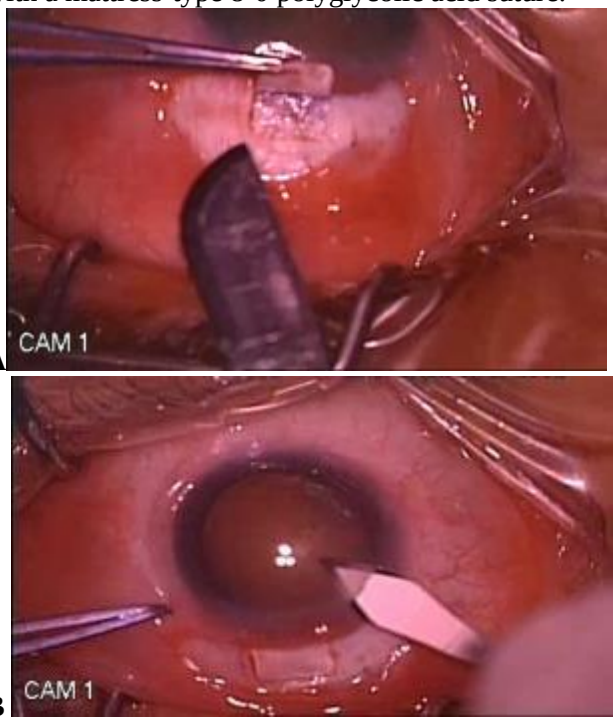

Figure 2.A- Rectangular partial-thickness scleral flap. **B-** Clear corneal separate incision.

Postoperative Follow-Up:

All patients received the same postoperative regimen. Specifically, a topical moxifloxacine and prednisolone were used four times daily for 3 weeks postoperatively in both groups and then tapered over 2 weeks.

Follow up visits at: the first postoperative day, first week, the first month, the third month, and the sixth month after the procedure.

Post-operative evaluations included: determination of BCVA and induced astigmatism, slit-lamp biomicroscopy, IOP measurement using Goldmann applanation tonometry and fundus examination. When IOP was found to be 20 mmHg or higher during follow-up, an antiglaucoma medication was prescribed or added if necessary.

Statistical analysis

Recorded data were analyzed using the statistical package for social sciences, version 20.0 (SPSS Inc., Chicago, Illinois, USA). Quantitative data of normal distribution were expressed as mean± standard deviation (St.Dev) and those of abnormal distribution were expressed as median, interquartile range (IQR). Qualitative data were expressed as frequency and percentage.

The following tests were done:

- Independent-samples t-test of significance was used when comparing between two independent variables.
- Paired sample t-test of significance: comparing between two related variables.
- Mann Whitney U test: two-group comparisons in non-parametric data.
- Wilcoxon Rank Sum test: comparison between two related samples in non-parametric data.
- Chi-square (x2) test of significance: comparison between two categorical variables.
- The confidence interval was set to 95% and the margin of error accepted was set to 5%. So, P-value less than 0.05 was considered statistically significant.

RESULTS

Fifty eight eyes of 48 patients who met the inclusion criteria were included in the study. Patients were randomized into two groups: Group I (n=29 eyes of 25 patients), who were subjected to one-site phacotrabeculectomy and Group II (n=29 eyes of 23 patients), who were subjected to the two-site procedure. Eight eyes of 6 patients were excluded from analysis because of loss at the follow-up (4 eyes of 2 patients from group I and 2 eyes of 2 patients from group II) and due to phaco related complications (2 eyes of 2 patients from group II).

Therefore, we report on the findings of the remaining 50 eyes of 42 patients. 29 eyes of female patients (16 in group I and 13 in group II) and 21 of male patients (9 in group I and 12 in group II) were operated, with age ranging from 47 to 74 years old.

Table (1): Comparison between groups regarding demographic data.

	Demographic Data	Group I *(n=25)*	Group II *(n=25)*	t/x2	p-value
Age (years)	Mean (St.Dev)	63.48(7.53)	61.76 (7.55)	0.651	0.424
	Range	47-74	47-74		
Sex	Female	16 (64.0%)	13 (52.0%)	0.739	0.390
	Male	9 (36.0%)	12 (48.0%)		

t-Independent Sample t-test; x2: Chi-square test; p-value >0.05 NS.

There was no statistically significant difference between groups regarding demographic data.

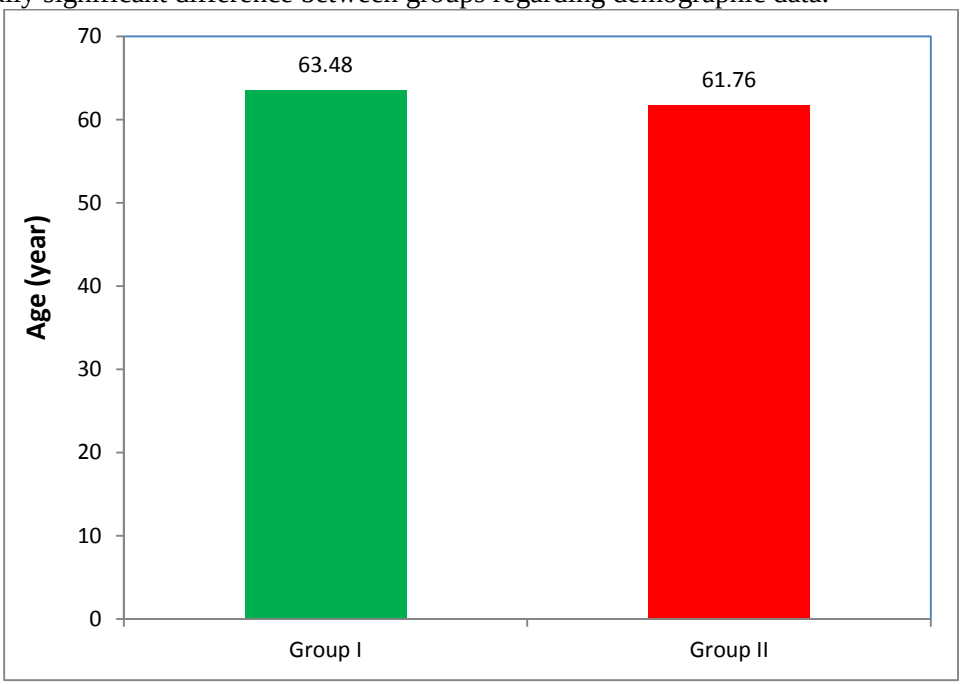

Fig. (3): Bar chart for comparison between groups regarding age (years).

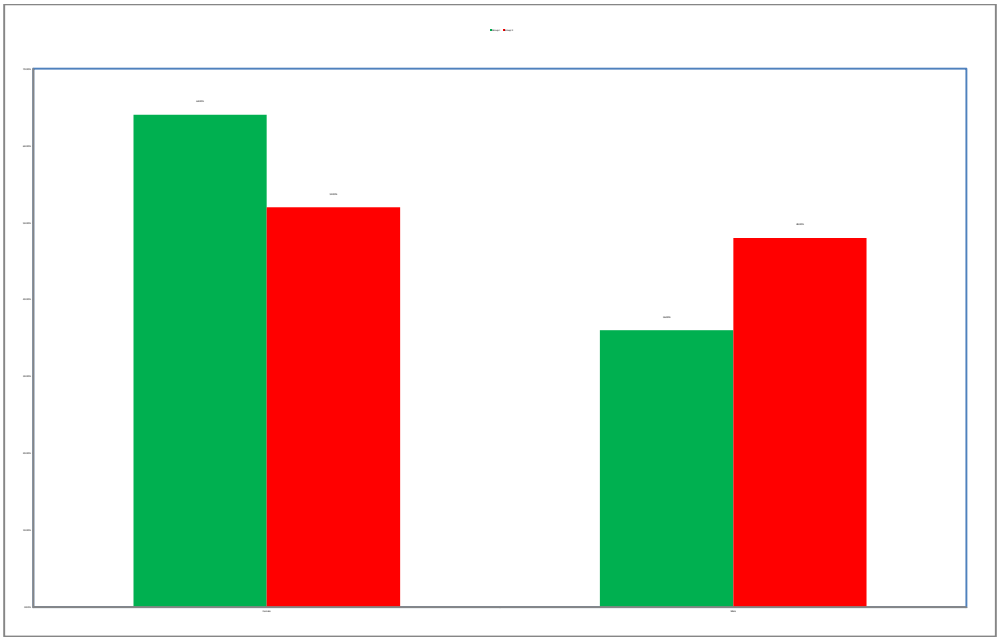

Fig. (4): Bar chart for comparison between groups regarding sex.

There was no statistically significant difference between groups regarding the vertical C/D ratio and the grade of nuclear cataract. The Lens Opacities Classification System III (LOCS III) was used for grading nuclear opalescence (NO).

Table (2): Comparison between groups regarding grade of nuclear opacity regarding The Lens Opacities Classification System III (LOCS III).

Grade of nuclear opacity	Group I (n=25)	Group II (n=25)	x2	p-value
I	0 (0.0%)	0 (0.0%)	3.778	0.286
II	0 (0.0%)	1 (4.0%)		
III	16 (64.0%)	20 (80.0%)		
IV	8 (32.0%)	4 (16.0%)		
V	1 (4.0%)	0 (0.0%)		
VI	0 (0.0%)	0 (0.0%)		

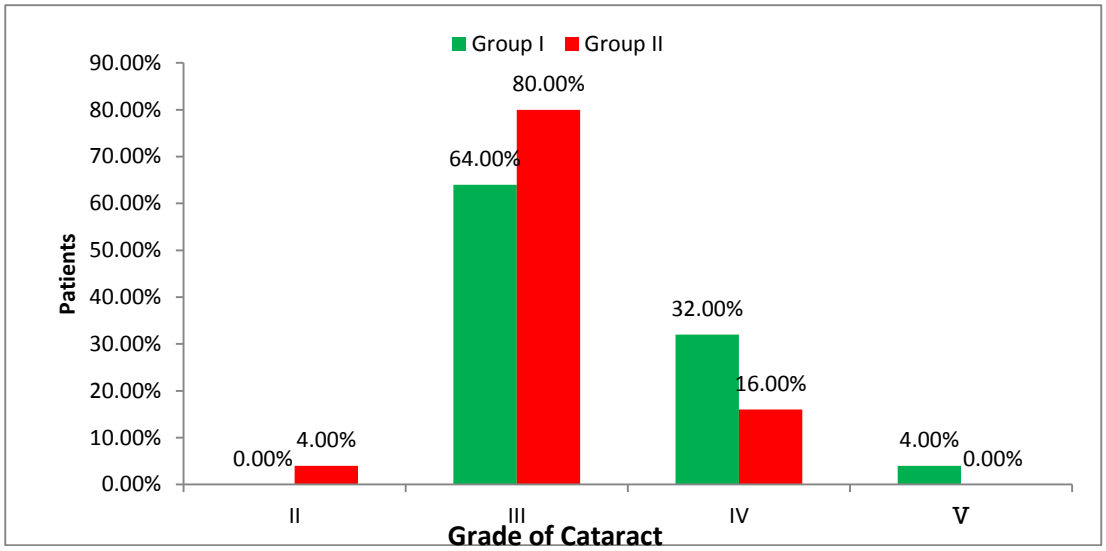

Fig. (5): Bar chart for comparison between groups regarding grade of cataract according to The Lens Opacities Classification System III (LOCS III).

Table (3): Comparison between groups regarding vertical C/D ratio.

Vertical C/D ratio	Group I *(n=25)*	Group II *(n=25)*	dent sample t-test	p-value
Mean(St.Dev)	0.56 (0.13)	0.60 (0.12)	1.297	0.260

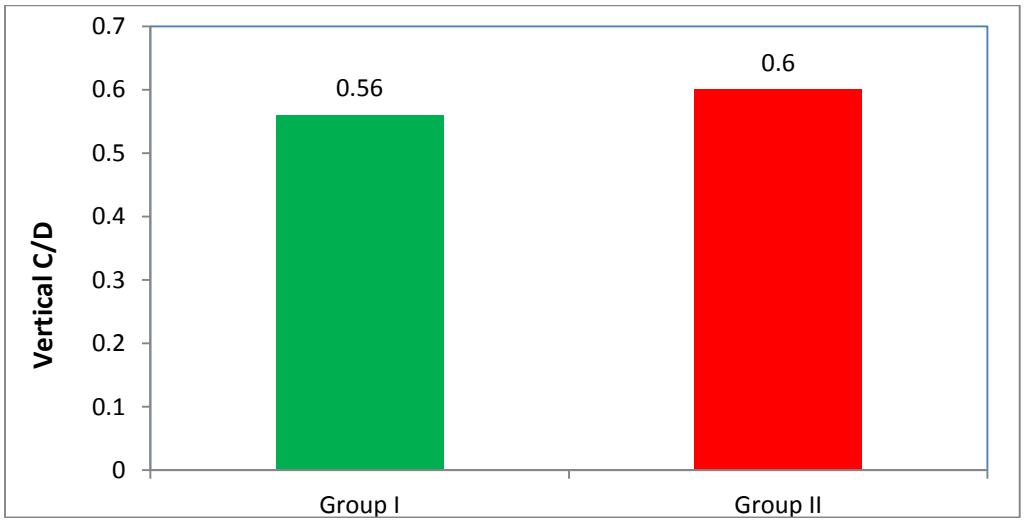

Fig. (6): Bar chart for comparison between groups regarding vertical C/D ratio.

In the current study, the mean postoperative IOP was reduced after surgery in both groups. In the one-site group the IOP was reduced from a median 23 mmHg (IQR 7) preoperatively to 15 mmHg (IQR 4) postoperatively, while in the two-site group the median IOP was reduced from a median 25 mmHg (IQR 10) preoperatively to 15 mmHg (IQR 4) postoperatively.

Table (4): Comparison between groups regarding Intra Ocular Pressure (IOP).

IOP	Group I *(n=25)*	Group II *(n=25)*	p-value
Preoperative			
Median	23.0	25.0	0.669
Range	15-33	16-33	
Postoperative			
Median	15.0	15.0	0.281
Range	10- 19	11-19	
Change			
Median	-10.0	-9.0	0.770
Range	-18- 0	-18- -4	
Wilcoxon Rank Sum test	**-4.203-**	**-4.383-**	
p-value	**<0.001****	**<0.001****	

IQR: Interquartile range

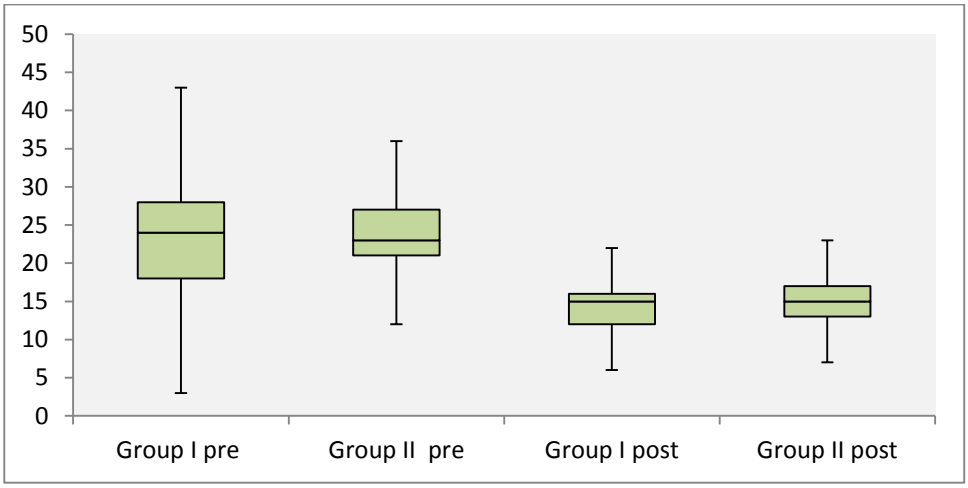

Fig. (7): Box Plot chart for comparison between groups regarding per and post-operative IOP.

There was no statistically significant difference in IOP between both groups. However a significant difference did exist between pre and post according to IOP in each group.

When IOP was found to be 20 mmHg or higher during follow-up, an antiglaucoma medication was introduced or added as necessary. IOP measurements during follow up are demonstrated in figure (8).

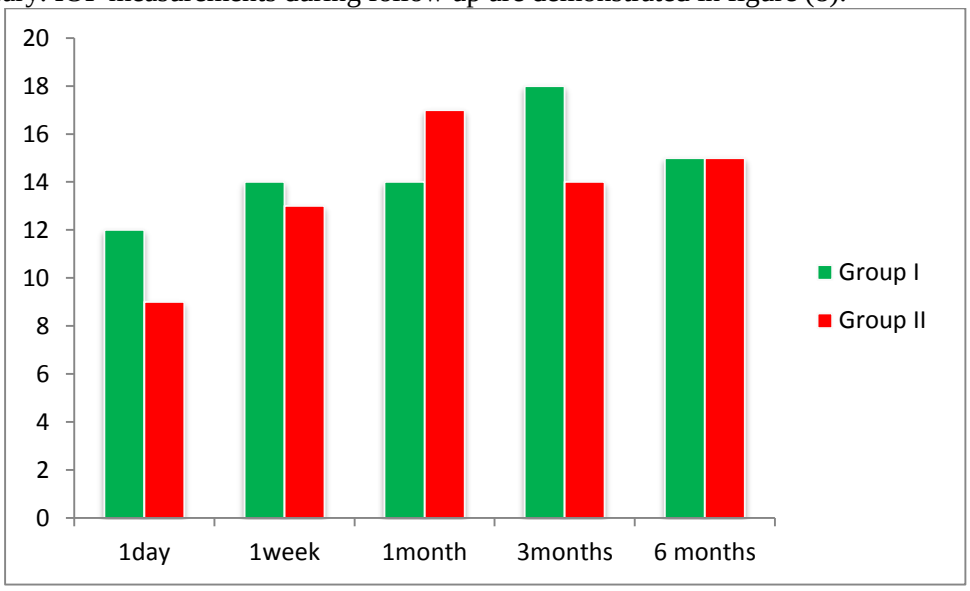

Fig. (8): Bar chart for comparison between groups regarding IOP measurements during follow up.

There was no statistically significant difference between both groups in terms of the number of glaucoma medications used postoperatively. All patients used fewer glaucoma medications after surgery.

Visual acuity following surgery improved in all cases included in our study. There was no statistically significant difference between groups in terms of change in BCVA. However, a significant difference between pre and post-operative BCVA in each group did exist. There was no significant difference in final visual outcome between the two techniques.

Table (5): Comparison between the Best Corrected Visual Acuity (BCVA) using logMAR notation in both groups before and after surgery.

	Group I *(n=25)*	**Group II *(n=25)***	**z-test**	**p-value**
Pre-operative Median Range	1.0 0.05-1.5	1.4 0.5-1.5	-1.379	0.168
Post-operative Median Range	0.4 0.2-0.8	0.4 0.2-1	0.000	1.000
Wilcoxon Rank Sum test	**-3.975-**	**-4.386-**		
p-value	**<0.001**	**<0.001**		

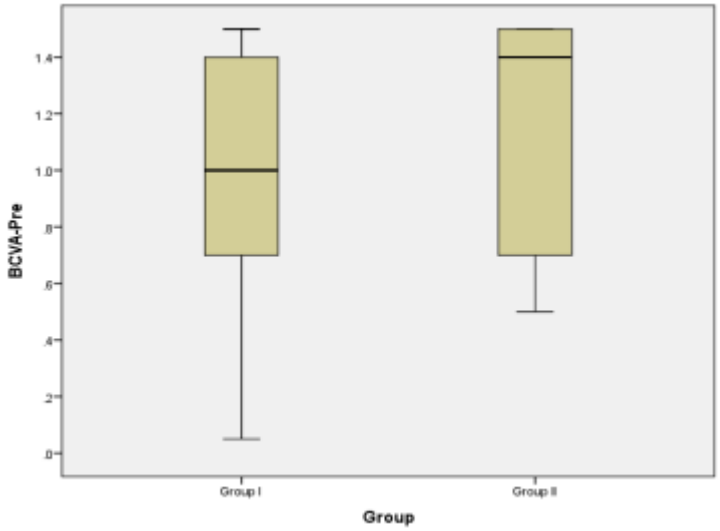

Fig. (9): Box plot chart for comparison between the best corrected visual acuity (BCVA) in both groups pre-operatively.

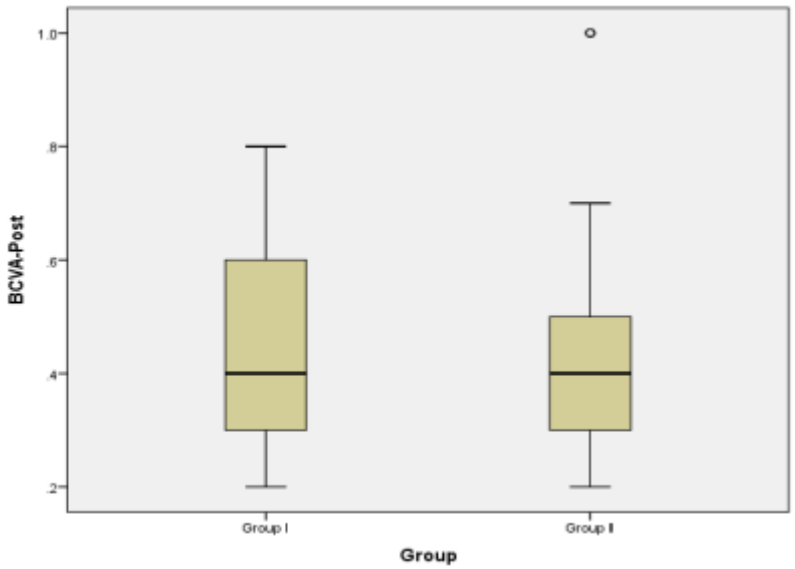

Fig. (10): Box plot chart for comparison between the best corrected visual acuity (BCVA) in both groups post-operatively.

Table (6): Comparison between groups regarding the refractive error (spherical equivalence).

Refractive error (Spherical equivalence)	Group I *(n=25)*	Group II *(n=25)*	z-test	p-value
Pre				
Median	-1.5	-1.5	-0.117	0.907
Range	-23-1.5	-20.5-1		
Post				
Median	-.5	-.25	-0.892	0.373
Range	-1.75-0.25	-1.5-0.5		
Wilcoxon Rank Sum test	**-2.976-**	**-3.188-**		
p-value	**0.003**	**<0.001**		

There was no statistically significant difference between groups according to refractive error (spherical equivalence).However, a significant difference between pre and post-operative refractive error "spherical equivalence" in each group did exist.

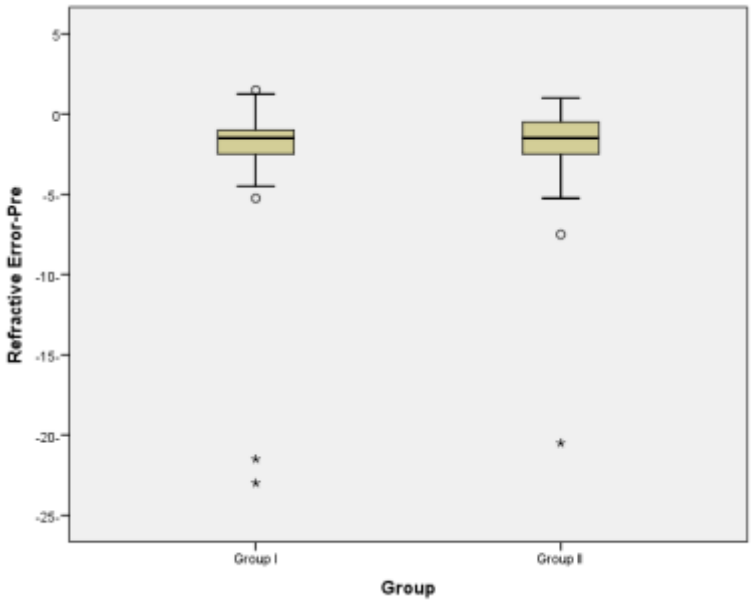

Fig. (11): Box plot for comparison between groups regarding preoperative refractive error (spherical equivalence).

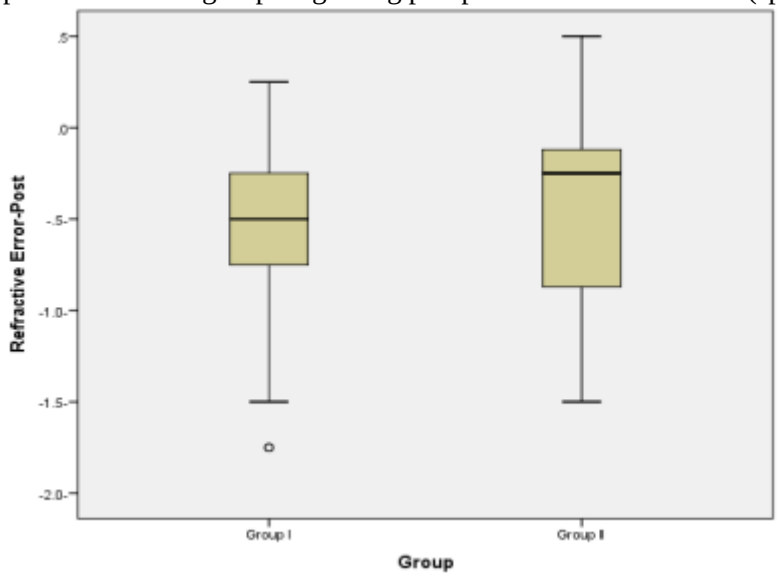

Fig. (12): Box plot for comparison between groups regarding postoperative refractive error (spherical equivalence).

Regarding astigmatism, 22 eyes (11 in each group) had astigmatism more than 1.5 diopters, 9 patients had lenticular type of astigmatism, we reported on the corneal changes of 15 eyes which had the corneal type of astigmatism (proven by keratometry).

Three eyes of group I and 4 eyes of group Ⅱ had with the role astigmatism, 3 eyes of group I and 2 eyes of group Ⅱ had against the role astigmatism, 3 eyes of group Ⅱ had oblique astigmatism and 2 eyes of group I developed surgical induced astigmatism.

Table (7): Comparison between groups regarding the number of eyes with preoperative astigmatism.

	Group I ***(n=25)***	**Group II** ***(n=25)***
With the role astigmatism	3(12%)	4 (16%)
Against the role astigmatism	3 (12%)	2 (8%)
Oblique astigmatism	0	3 (12%)

Both groups are improved equally regarding with the role astigmatism, while group Ⅱ showed more improvement against the role astigmatism, also group Ⅱ showed improvement regarding oblique astigmatism. Two eyes of group Ⅰ had developed surgical induced astigmatism.Corneal astigmatism equal to 1.5 diopter or more was studied; the lenticular element of astigmatism was not included in the comparison between the two procedures as we focused on the corneal changes resulting from each technique.

Astigmatic correction in our surgeries was achieved by choosing the location of corneal incision based on pre-existing astigmatism (placement of surgical wound along the steep axis evidenced by keratometry) to alter the corneal curvature by flattening the cornea in the meridian in which it was placed. Adjusting suture tightness (control of tightness of flap sutures) was used to alter the curvature of cornea by steepening the cornea in the meridian in which it was placed.

Table (8): Comparison between groups regarding changes of astigmatism

		Group I	Group II	t-test	p-value
With the role astigmatism	**Preoperative** Mean(St.Dev)	-4.58(1.28)	-2.88(1.13)	3.521	0.119
	Range	-6- -3.5	-4.5- -2		
	Postoperative Mean(St.Dev)	-1.42(1.01)	-1.19(0.88)	0.104	0.76
	Range	-2.5- -0.5	-2.5- -0.75		
Against the role astigmatism	**Preoperative** Mean(St.Dev)	-1.75(0.25)	-2.63(0.18)	17.64	0.025
	Range	-2- -1.5	-2.75- -2.5		
	Postoperative Mean(St.Dev)	-1.33(0.38)	-0.88(0.18)	2.342	0.223
	Range	-1.75- -1	-1- -0.75		
Oblique astigmatism	**Preoperative** Mean(St.Dev)	--	-2.75(1.39)	--	--
	Range	--	-4.25- -1.5		
	Postoperative Mean(St.Dev)	--	-1.00(0.25)	--	--
	Range	--	-1.25_-0.75		
Surgically Induced astigmatism	Mean(St.Dev)	-1.75(0.35)	--	--	--
	Range	-2- -1.5	--		

Regarding changes in keratometric readings, all eyes were studied. There was no statistically significant difference between groups according to K1 readings. Also, no statistically significant difference was found between pre and postoperative K1 readings in each group.

Table (9): Comparison between groups regarding K1 readings.

K1	Group I *(n=25)*	Group II *(n=25)*	z-test	p-value
Pre				
Median (IQR)	43.5 (3)	43.75 (3)	-0.758	0.449
Range	41.25-47.5	40.75-47		
Post				
Median (IQR)	43.0 (3)	43.25 (3)	-0.768	0.443
Range	41.25-47	40.25-47.25		
Change				
Median (IQR)	-.25 (1)	-.10 (1)	-1.422	0.155
/Range	-4-4.5	-4-0.5		
Wilcoxon Rank Sum test	**-2.004-**	**-1.283-**		
p-value	**0.045**	**0.200**		

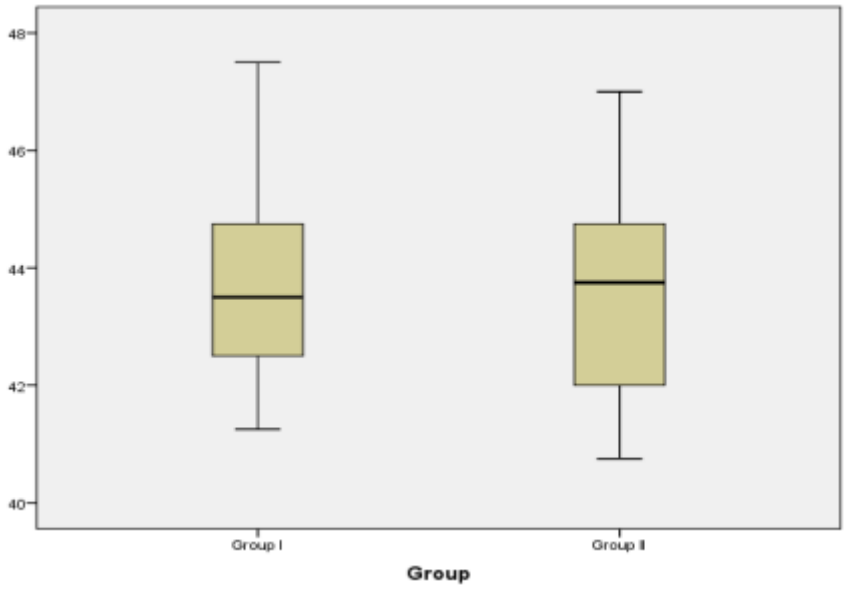

Fig. (13): Box plot for comparison between groups regarding preoperative K1 readings.

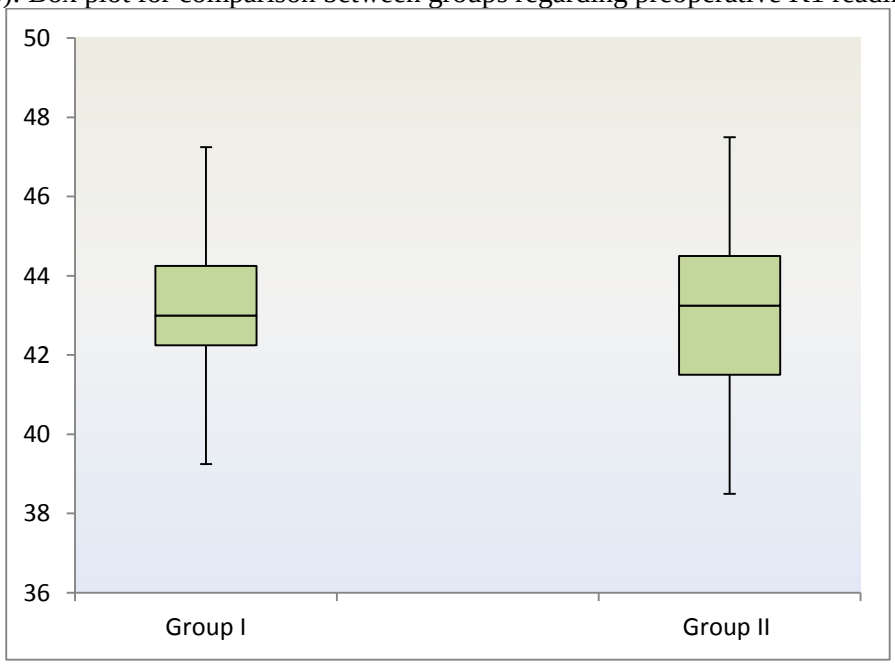

Fig. (14): Box plot for comparison between groups regarding postoperative K1 readings.

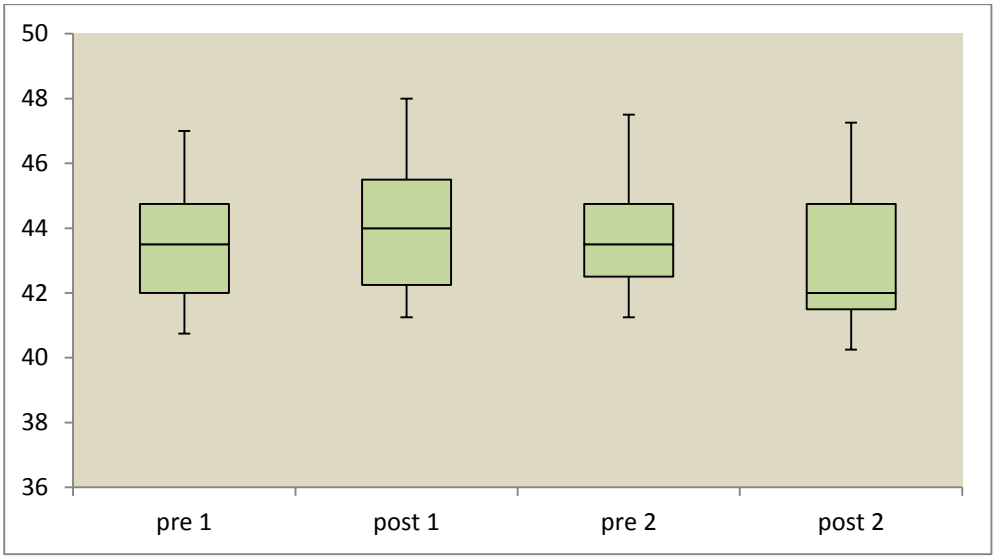

Fig. (15): Box plot for comparison between groups regarding pre and post-operative K1 readings.

There was no statistically significant difference between groups regarding K2 readings. However, a statistically significant difference was found between pre and postoperative K2 readings in each group.

Table (10): Comparison between groups regarding K2 readings.

K2	**Group I *(n=25)***	**Group II *(n=25)***	**z-test**	**p-value**
Preoperative Median Range	 45.0 41.5-49.9	 45.25 42.5-50	-1.012	0.312
Postoperative Median Range	 44.25 41.25-49	 44.4 42.25-48.75	-0.816	0.414
Wilcoxon Rank Sum test	**-3.468-**	**-2.193-**		
p-value	**<0.001****	**0.028***		

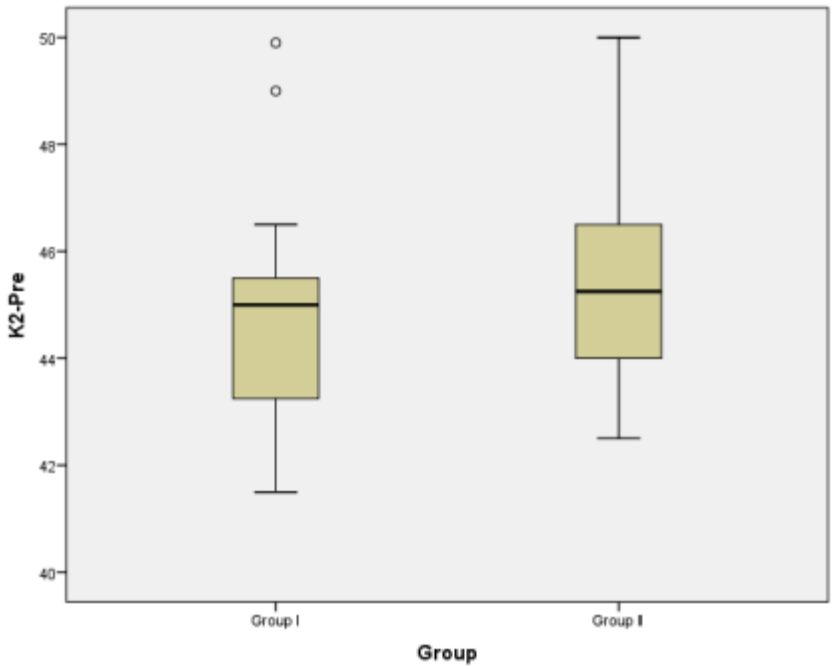

Fig. (16): Box plot for comparison between groups regarding preoperative K2 readings.

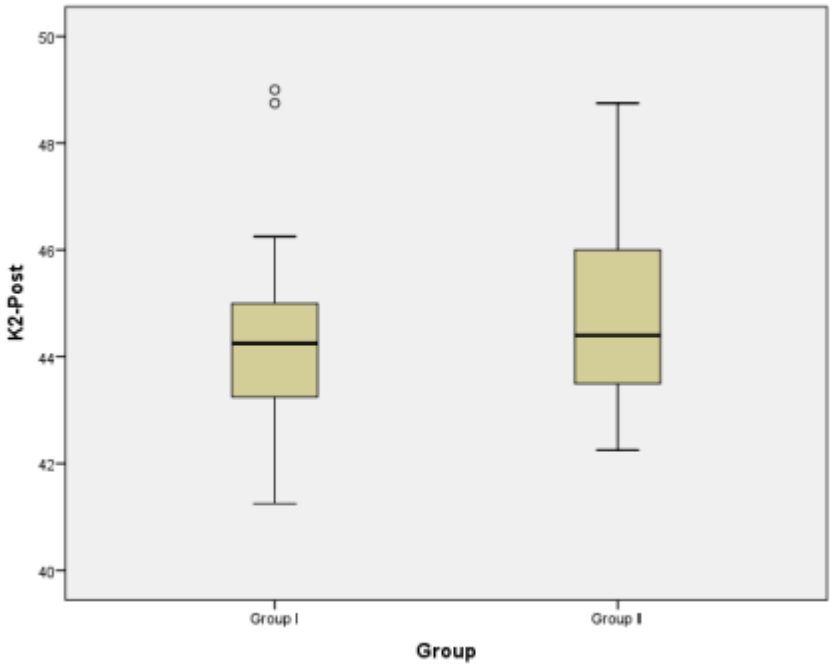

Fig. (17): Box plot for comparison between groups regarding postoperative K2 readings.

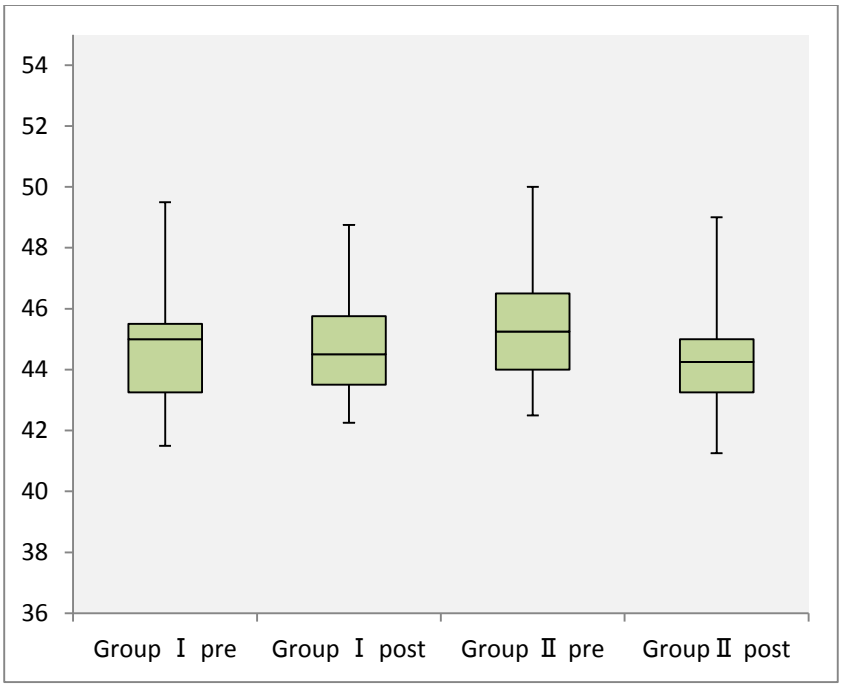

Fig. (18): Box plot for comparison between groups regarding pre and post-operative K2 readings.

Concerning the intraoperative and postoperative complications, they were few and relatively similar in one- and two-site phacotrabeculectomy.

No major postoperative complications occurred in either group. We only encountered two minor postoperative complications in two patients one in each group. Patients presented with shallow anterior chamber (no irido-corneal touch) and hypotony (IOP 6 mmHg) and treated by contact lens application, improved within two weeks without need for surgical intervention.

Duration of surgery was studied and there was no significant difference between groups. The main (St.Dev) duration in the one site group was 49(5) minutes and in the two site group was 52(6) minutes.

DISCUSSION

Once it is clear that a patient requires cataract and glaucoma surgery, the decision made to perform the two procedures concurrently. The question is whether the one- or two-site combined phacotrabeculectomy is safer and more effective in improving vision and decreasing IOP [5].

In the current study there was no statistically significant difference between the two groups in age,

sex, preoperative BCVA, pre- operative IOP, CD ratio and number of glaucoma medications used before the operation.

Duration of surgery:

In the current study, we found that the two procedures consumed the same operative time except 2 eyes (10 minutes longer) in group Ⅱ when temporal corneal incision was used to treat against the role astigmatism.

Gunning and Greve reported that two-site surgery took statistically significantly more time than one-site surgery[7].

This may be explained by changing the position and readjusting the microscope to approach clear temporal corneal incision in these studies, while in our study the trab was performed at the 12 o'clock position and the clear corneal incision was performed at the 10 o'clock position and so no need for changing the position and readjusting the microscope.

IOP changes:

As far as the IOP is concerned in our study, the postoperative IOP was reduced after surgery in both groups. In the one-site group the median preoperative IOP (with medications) was 23 mmHg (range 15-33 , IQR 7) and reduced to 15 mmHg (IQR 4) postoperatively, while in the two-site group the median preoperative IOP was 25 mmHg (range 16-33 , IQR 10) and reduced to 15mmHg (IQR 4) postoperatively. There was no statistically significant difference in IOP between both groups

Previous studies suggested that there was no statistically significant difference in postoperative IOP between one- and two-site procedures [8].

Although another meta-analysis of randomized controlled trials supported that the two-site phacotrabeculectomy is superior to the one-site procedure in reducing IOP [9].

Manipulations with scleral flap in the one-site technique may render the flap integrity and stability less than it is in the two-site technique especially in the early post-operative period.

Thus, with the same tightness of scleral flap sutures in both procedures, filtration through the very intact flap in the two-site group may be lower than filtration through poor coapted (lacerated) edges of the scleral flap in one-site group.

Our results show that both techniques are effective equally in lowering IOP, and there was no significant difference between the two groups at the end of the follow-up period. Also reoperation for glaucoma was not required in all cases.

Number of glaucoma medications:

All patients studied used fewer glaucoma medications after surgery. The maximal number of glaucoma medications needed postoperatively in the two-site group was 1 while in in the one-site group was 2.

There was no statistically significant difference in the number of glaucoma medications used postoperatively. Only one patient in the one-site group needed two glaucoma medications postoperatively in order to achieve adequate control of IOP.

The percentage of patients who didn't need antiglaucoma medications postoperatively was greater in the two-site group (18eye; 72% of all patients in the group) compared to the one-site group (15 eye; 60% of all patients in the group).

In contrary to our study, ***Shingleton et al***. found that at the end of follow-up the one-site group required significantly more medications than the two-site group[10].The one-site technique was effective but necessitated the use of more antiglaucoma medications in order to reach the same level of IOP as the two-site technique. This can be attributed to increased manipulation of the conjunctival and scleral flaps, and therefore, increased fibrosis[11].

The topical increase in temperature at the trabeculectomy site and at the scleral flap caused by the heat production by the phaco probe is another possible factor contributing to decreased efficacy of the one-site procedure [12].

In contrast, our study found that no statistically significant difference in the number of glaucoma medications used postoperatively, this is may be due to the low temperature of the torsional Ultra Sound (US) and the use of mitomycin C which decrease the fibrotic process triggered by flap trauma in the one site procedure. ***Bokkwan et al***. found that incision temperature influenced by US modality was significantly lower with torsional US than with longitudinal US [13].

Similar to our study, other prospective study concluded that there was no statistical difference in the postoperative mean number of antiglaucoma medications or number of patients on antiglaucoma therapy in one- versus two-site phacotrabeculectomy [14].

Furthermore, all patients in both groups required fewer postoperative antiglaucoma medications. However, the number of postoperative medications was not significantly different in both groups; it was lower in the two-site group than in the one-site group.

Visual acuity and refractive outcomes:

Visual acuity following surgery improved in all cases included in our study. In addition, no significant difference was observed in visual outcome between the two techniques.

Both groups are improved according to the role (WTR) astigmatism. Group Ⅱ patients are improved regarding against the role (ATR) astigmatism, while minimal improvement in group Ⅰ. Also Group Ⅱ

patients are improved regarding oblique astigmatism , there were no patients with oblique astigmatism in group I.

By changing the site of corneal incision in the two-site group, we can treat some of the corneal astigmatism but we cannot do so in the one-site group. Also tightness of stitches of the scleral flap may induce astigmatism, so the refractive state preoperatively and definitely the corneal astigmatism (proven by keratometry) is another factor in the choice between the two procedures.

Because of the small number of eyes with corneal astigmatism included in the study and the lack of published studies comparing the corneal changes with each procedure, our findings cannot be generalized and more researches are needed to be carried out to shed more light on this issue.

Similar to our study, previous study reported an increase in WTR astigmatism suggesting the possibility of tight sutures and also a posteriorly placed wound gape from the internal sclerostomy as the cause **[15].**

In contrast, a study compared the refractive results of phacoemulsification alone and one-site phacotrabeculectomy, and showed that the difference in postoperative induced astigmatism was not statistically significant **[16].**

Wound-healing process was considered to be also active in the process of inducing WTR astigmatism **[17].**

Regarding K1 readings, there were almost the same in both groups pre and postoperatively, while K2 was reduced from 45 (IQR 2) to 44.25 (IQR 2) in the one-site group, from 45.25 (IQR 3) to 44. 4 (IQR 3) in the two-site group, so improvement at the level of corneal astigmatism was reported.

Previous study had shown that a scleral tunnel induces less corneal astigmatism compared to a clear corneal incision in cataract surgery **[18].**

Other authors had concluded that an incision at the 12 o'clock position induces more astigmatism when compared with a temporal incision **[19].**

Complications:

When considering complications, a combined procedure does not avoid any of the complications of cataract surgery alone or trabeculectomy alone, although it does not necessarily increase them. Performing two procedures rather than one should theoretically double the risk of endophthalmitis occurring at the time of the surgery as well as anesthetic complications. If the procedure is done under topical anesthetic, however, then the risk of anesthetic complication is negligible.

Concerning the intraoperative and postoperative complications, they were few and relatively similar in one- and two-site phacotrabeculectomy.

Both methods were safe to perform, and we experienced intra-operative complications in two patients, one from each group, they had complicated by rupture of posterior capsule during phacoemulsification and treated by anterior vitrectomy and sulcus placed hard IOL, both were excluded from statistical analysis.

Moreover, no major postoperative complications occurred in either group. We only encountered two minor postoperative complications in two patients one in each group. Patients presented with shallow anterior chamber (no irido-corneal touch) and hypotony (IOP 6 mmHg) and treated by contact lens application, improved within two weeks without need for surgical intervention.

The incidence of hypotony as a postoperative complication varies greatly between different studies, ranging from as low as 1.5% **[20]** to 38% **[21]**.This is in part due to the non-standardized definition of hypotony and the use of different anti-metabolites **[22]**.

In our study, patients presented with hypotony occurred early postoperatively and subsequently resolved, with the bleb formed within 3 weeks.

The low incidence rate of hypotony in our study may be due to the adequately adjusted flap and conjunctival sutures and may be also due filling the anterior chamber with air at the end of surgery.

This suggests that the surgeon factor also plays an important role in determining the early post-operative IOP, which includes the tension of sutures, number of sutures, immediate IOP at the end of surgery and timing of suturelysis **[23]**.

CONCLUSION

Both approaches can be performed in patients with POAG with the expectation of equal improvement of VA and IOP control.

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