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Original Article

Comparison of the clinical efficacy and safety of deep sclerectomy with mitomycin-c and trabeculectomy surgeries

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Abstract

Aim: Comparison of clinical efficacy and safety of trabeculectomy and deep sclerectomy with mitomycin-C (MMC) surgeries.
Material and Methods: 58 eyes of 58 patients with glaucoma who underwent trabeculectomy or deep sclerectomy with MMC were evaluated retrospectively. The success criterion was regarded as follows; patients having intraocular pressure (IOP) less than 21 mmHg was regarded as complete success; patients with IOP less than 21 mmHg with medication was regarded as partial success; and patients with IOP higher than 21 mmHg with medication was regarded as un-success.
Results: There was no statistically significant difference in IOP lowering effects between the two surgeries. Considering the success of the groups; complete success was achieved in 32 patients (91.4%) and partial success in 3 patients (8.6%) in the trabeculectomy group. Complete success was achieved in 20 patients (86.9%) and partial success in 3 patients (13.1%) in the deep sclerectomy with MMC group. In the deep sclerectomy with MMC group, hypotonia was detected in 2 patients (8.7%). In the trabeculectomy group, 5 patients (14.3%) had hypotonia, 2 patients (5.7%) had shallow anterior chamber and 1 patient (2.85%) had choroidal detachment.
Conclusion: When IOP lowering effects of deep sclerectomy with MMC and trabeculectomy operations were compared, it was found that there was no statistically significant difference between the two techniques. When complication rates were compared, less complication was found in deep sclerectomy operations. It can be concluded that deep sclerectomy is safer than trabeculectomy and as effective as it is.

Keywords: Deep Sclerectomy; Glaucoma; Trabeculectomy.

INTRODUCTION

Glaucoma, which was first described by Hippocrates in elderly people and described as light blue discoloration in the pupil, was initially thought to be the same pathology as cataract. The concept of high intraocular pressure (IOP) could only be found in the 18th century in the definition of the disease (1). With the emergence of the concept of normotensive glaucoma in the following years, high IOP has ceased to be regarded as one of the main characteristics of the disease and has been accepted as a major risk factor (2).

Nowadays, glaucoma, one of the most common blindness causes, is being studied intensively because of its insidious course and progression to blindness if not treated. Today, glaucoma; is defined as a group of diseases with optic neuropathy and accompanied characteristic visual field losses and having high IOP as main risk factor. IOP, the most important risk factor that can be controlled, remains the main target of medical and surgical treatments of glaucoma (3). IOP is important not only for the diagnosis of glaucoma; it is also one of the important parameters used in the evaluation of the disease follow-up and the response to the treatment. IOP is a significant risk factor in glaucoma and the reduction of IOP by treatment has been demonstrated by several studies that have slowed glaucoma progression. In an early-phase glaucoma treatment study, it has been reported that every 1 mmHg

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decrease in IOP provides a 10% reduction in the risk of progression of visual field loss and progression of visual field losses decreased with treatment in normotensive glaucoma cases (3).

Medical treatment and laser methods are first tried in glaucoma treatment. Surgical methods are used in the eyes that have no effective IOP reduction with these therapies and in patients with advanced disease at admission. Trabeculectomy, which is the most preferred surgical method today; is a fistulizing glaucoma operation aimed at lowering the IOP by providing the drainage of the aqueous humor to the subconjunctival space.

In recent years, surgical methods have significantly increased. Although trabeculectomy is a surgical technique with high success rate, it may cause complications in some cases. One of the main reason of complications is entering through the anterior chamber during surgery. In order to avoid possible complications of trabeculectomy, deep sclerectomy, a surgical technique not entering into the anterior chamber, was investigated.

Wound healing and scar formation, which is a natural process after surgery, is the main reason causing success loss in filtration surgery. Scar tissue resulting from fibroblast proliferation after trabeculectomy can cause non-functional fistulas. Several agents have been studied to prevent this. Of these, 5-fluorouracil (5-FU) and Mitomycin-C (MMC) are the most commonly studied agents. MMC has become the most cured agent in recent years because it has easier clinical use than 5-FU and has less side effects and complications (4,5).

The aim of this study was to screen the hospital records of patients who underwent trabeculectomy or deep sclerectomy with MMC and to compare the clinical efficacy and safety of both surgical techniques by investigating preoperative and postoperative visual acuity, IOPs, anterior chamber depth, and macular thickness measurements.

MATERIAL and METHODS

This study was carried out in Ministry of Health Göztepe Training and Research Hospital Eye Clinic by giving information about glaucoma and applied surgery to all patients and their relatives in compliance with the requirements of the Helsinki Declaration. The permission required for the study was obtained from the Ethics Committee of S.B Goztepe Training and Research Hospital (Date of Decision: 27.03.2008, Decision No: 45/0).

The files of the patients who underwent deep sclerectomy or trabeculectomy between April 2004 and February 2008 were evaluated retrospectively. Cases with regular follow-up of at least 24 months were included in the study, while those who had less than 24 months of follow-up and whose controls were not performed regularly were excluded from the study. Patients with progressive visual field defects, progressive glaucomatous optic nerve damage, decreased visual acuity, primary open angle glaucoma or pseudoexfoliation glaucoma were included in the study. Patients with an eye disease other than primary open-angle glaucoma or pseudoexfoliation glaucoma, who had previously undergone an ophthalmic surgery and had any systemic disease associated with retinopathy were excluded from the study.

The patients were preoperatively followed-up by the glaucoma department in our hospital. In patient files; when the patients were first referred to the glaucoma department, their ages, genders, medical histories, medications, visual acuities, biomicroscopic findings, IOP values, fundus findings, optic disc cupping rates, visual field tests, optical coherence tomography (OCT) findings, and operations performed, complications encountered and the findings of the examination performed after the surgery were all recorded.

The best visual acuity of all patients was corrected according to ETDRS (Early Treatment Diabetic Retinopathy Study) in pre-operative period. Biomicroscopic examinations were performed. IOP measurements were performed with Goldman applanation tonometry. Iridocorneal angle examination was performed with Goldman's three mirror lens and routine fundus examination was performed with a 90-degree lens with a biomicroscope. Anterior chamber depth was measured by Sonomed A Scan A 2500 Biometry. Retinal thickness measurements were made in the foveal area of 1 mm with Zeiss Stratus 3000 OCT. Visual field examination was performed with Humphrey Field Analyzer 750I.

When the OCT measurement was performed, after the patient fixation was carefully checked, in the rapid macular thickness measurement mode of the device, each measurement was repeated 2-3 times and the best signal intensity was recorded. Retinal thickness was measured in 1 mm diameter area with fovea center.

In our clinic, trabeculectomy and deep sclerectomy with MMC are performed using surgical microscopy under local anesthesia. Today's routine trabeculectomy and deep sclerectomy procedures can be explained as follows.

Trabeculectomy

Patients were given 10 mg intramuscular (im) diazepam half an hour before the operation for preoperative sedation. For local anesthesia, peribulbar anesthesia on two quadrants was preferred. After waiting for 15 minutes, the surgical area was cleaned with 10% povidone iodine and covered with sterile drape. Bridle suture was placed on the upper rectus with the 4.0 silk suture. Fornix-based conjunctival flap was prepared at 12 o'clock, tendon was removed from the episclera by blunt dissection and a portion was excised. Following the wet cauterization of the episcleral vessels, using a 45º knife, having the half thickness of the sclera, a square-shaped scleral flap with the dimensions of 4 × 4 mm was prepared. From the upper temporal quadrant paracentesis was performed with MVR knife. In the trabecular area under the scleral flap, two radial incisions were made with a 15º knife and then the posterior border of the trabecular block

was cut. The anterior borders of two radial incisions are cut with Westcott scissors and peripheral iridectomy is performed. The scleral flap was fixed to the scleral bed from two corners with 10.0 nylon sutures. Fluid passage from trabeculectomy opening was evaluated by giving fluid to the anterior chamber through the opening of the paracentesis. The sutures were loosened or additional sutures were placed according to the requirements. The conjunctiva was closed with 8.0 vicryl sutures. After subconjunctival 1 cc gentamycin and dexamethasone mixture is injected into the lower nasal area, the eye is closed with antibiotic drops.

Deep sclerectomy

Diazepam 10 mg im was performed half an hour before the operation for the purpose of preoperative sedation. For local anesthesia, peribulbar anesthesia on two quadrants was preferred. After waiting for 15 minutes, the surgical area was cleaned with 10% povidone iodine and covered with sterile drape. Bridle suture was placed on the upper rectus with the 4.0 silk. After preparing the fornix-based conjunctival flap at 12 o'clock, tendon was separated from the episclera by blunt dissection and a portion was excised (Figure 1). Following wet cauterization of exposed episcleral vessels, 0.2 mg/ml MMC impregnated sponges were applied to the surgical area and under the tendon for 2.5 minutes (Figure 2).

Figure 1. Preperation of fornix-based conjunctival flap

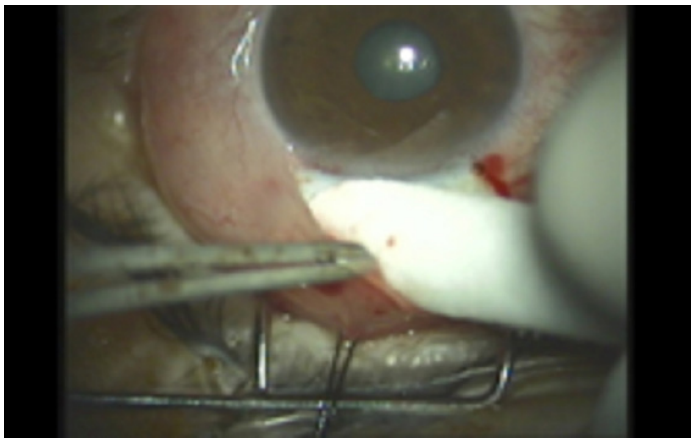

Figure 2. Mitomycin-C administration

The surgical area was then washed with 20 ml of balanced salt solution. A 5x5 mm square superficial scleral flap was prepared having 1/3rd of scleral thickness with a 45º knife (Figure 3).

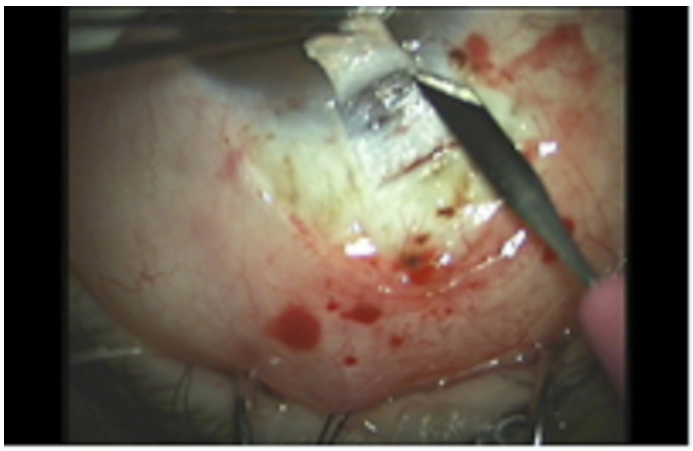

Figure 3. Preparation of superficial scleral flap

This scleral flap was extended 1.5 mm towards the transparent cornea. A 4x4 mm deep scleral flap was prepared to the bed of this flap (Figure 4).

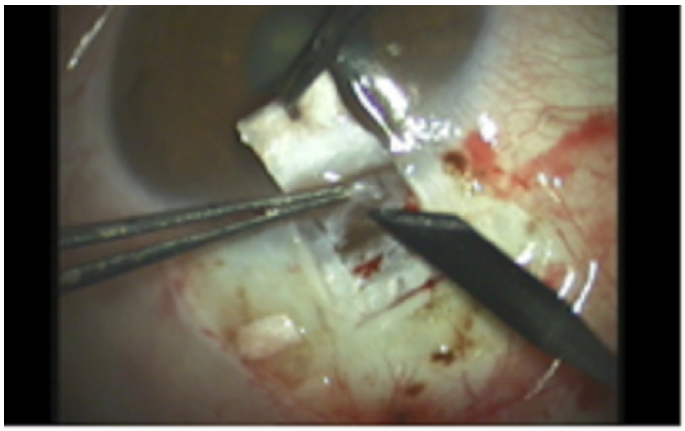

Figure 4. Preparation of deep scleral flap

It was noted that the thickness of the deep scleral flap would include 90% of the remaining scleral thickness. This flap was extended to the cornea to open the roof of the schlemm channel and to reveal the Descemet's membrane.

At this stage, the aqueous humor began to glide through the formed trabeculo-descemetic membrane, and to lie on the scleral bed. With the tip of the sponge, the collagen fibers on the Descemet's membrane were removed and the flow of the aqueous was increased. A small incision was made vertically to the origin of the schlemm channel on both sides of the scleral bed, and the lower wall of the schlemm channel was peeled off with a thin pencet, and the deep flap was removed by cutting off (Figure 5).

The superficial scleral flap was closed with 10.0 nylon sutures (Figure 6).

The conjunctiva was tightly closed with 8.0 vicryl suture. Subconjunctival 1 cc gentamycin and dexamethasone mixture was injected into the lower nasal region and the eye was closed with antibiotic drops.

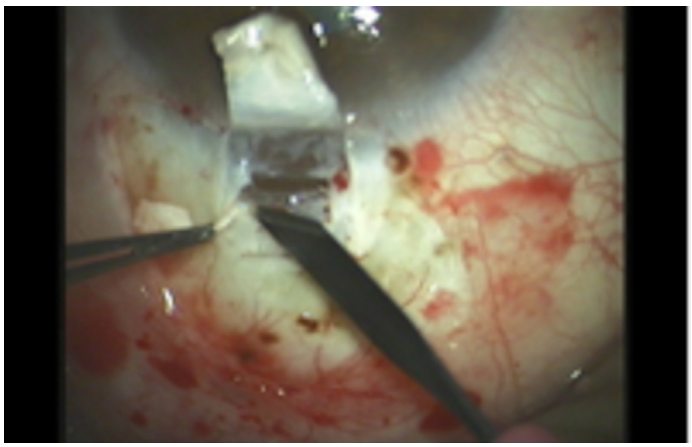

Figure 5. Peeling of Schlemm channel

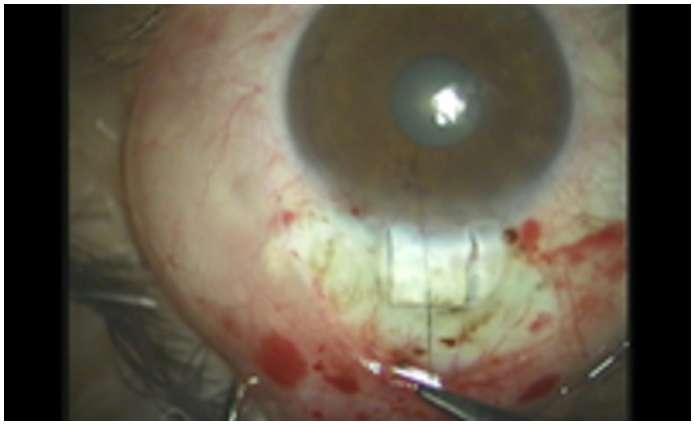

Figure 6. Suturing the superficial scleral flap

On postoperative day 1, antiglaucomatous drugs were discontinued after the eyes were opened. 5 × 1 topical antibiotics, 5 × 1 topical steroids (reduced from 1st week) and 3 × 1 cycloplegine drops were given as standard for 5 weeks.

Control examinations were performed on the postoperative 1st day, 3rd day, 1st week, 2nd week, 1st month, 3rd month, 6th month, 12th month, 18th month and 24th month.

On the first day visual acuity, IOP, anterior chamber depth, measurements were taken and on the other controls, these measurements were performed together with macular thickness measurements in the foveal 1 mm diameter area with OCT (Figure 7).

The decrease in IOP as a success criterion was taken into consideration. The success criterion was regarded as follows; patients having IOP less than 21 mmHg was regarded as complete success; patients with IOP less than 21 mmHg with medication was regarded as partial success; and patients with IOP higher than 21 mmHg with medication was regarded as un-success. Mean IOP values, visual acuities, anterior chamber depths, macular thickness measurements and decreases in IOP were statistically compared before and after the operations in both treatment groups.

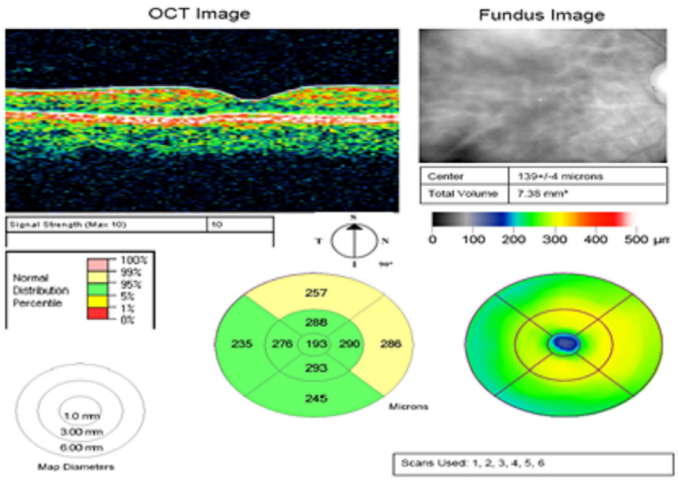

Figure 7. Macular thickness measurement in foveal 1 mm diameter area by OCT

Statistical Analyses

In this study, statistical analysis was performed by NCSS (Number Cruncher Statistical System) package program. In the evaluation of the data, descriptive statistical methods (mean, standard deviation) as well as repetitive variance analysis of multiple groups, Newman Keuls multiple comparison test for subgroup comparisons, independent t test for comparison of paired groups and chi-square test for comparison of qualitative data were used. The significance level was set at $p < 0.05$ level.

RESULTS

Fifty-eight eyes of 58 patients were included in the study. Twenty three patients underwent deep sclerectomy with MMC and 35 patients underwent trabeculectomy. The age of all cases ranged from 45 to 76 years in both groups. Of the 23 patients in the deep sclerectomy group, 7 (30.4%) had pseudoexfoliation glaucoma and 16 (69.6%) had primary open angle glaucoma. Of the 35 patients in the trabeculectomy group, 13 (37.1%) had pseudoexfoliation glaucoma and 22 (62.9%) had primary open angle glaucoma. The demographic findings of the patients are summarized in Table 1.

Table 1. The demographic findings of the patients

		Deep Sclerectomy Group	Trabeculectomy Group	t	p
Age		60.17±5.71	57.66±6.62	1.49	0.141
Gender	Male	8 %34.8)	21 (%60)		
	Female	15 (%65.2)	14 (%40)		

There was no statistically significant difference between the mean ages of deep sclerectomy with MMC and trabeculectomy groups ($p = 0.141$). No statistically significant difference was observed between the sex distribution of the deep sclerectomy with MMC and trabeculectomy groups ($p = 0.06$).

Gonioscopic examination was performed preoperatively and all patients were defined as open angle (grade 3,4). Visual field examinations revealed glaucoma specific visual field loss in all patients.

Deep sclerectomy operations with MMC were completed without any intraoperative complications. Postoperative hypotonia was detected in 2 patients (8.7%) in the deep sclerectomy group with MMC. In one of these cases, IOP values were determined as 4 mmHg on the 1st and 3rd days; no hypotonia was observed in the control examinations at the first week. In the other patient, IOP values were determined as 5 mmHg on the 1st and 3rd days; no hypotonia was observed in the control examinations at the first week. Since the anterior chamber formation was complete in both cases, the patients were followed up without any interventions. Complete success was achieved in 20 patients (86.9%) in the deep sclerectomy with MMC group and partial success was achieved in 3 patients (13.1%) requiring additional medication.

In the trabeculectomy group, 2 patients (5.7%) had hemorrhage in the anterior chamber during the operation. Both patients received viscoelastic agents in the anterior chamber and the bleeding was controlled intraoperatively. Hyphema was not observed in the postoperative controls of both patients. Hypotonia was detected in 5 patients (14.3%) in the trabeculectomy group. In 2 patients with hypotonia (5.7%), a shallow anterior chamber and in 1 (2.85%) patient choroidal detachment were detected. A tight bandage was performed on 2 patients with shallow anterior chamber. Anterior chamber formation was achieved in both patients at day 3 and no hypotonia was observed on the first week controls. The patient with choroidal detachment was treated with strict bandage. While no hypotonia was observed at 1st week, choroidal detachment was not observed at the first month **(Figure 8).** Complete success was achieved in 32 patients (91.4%) in the trabeculectomy group and partial success was achieved in 3 patients (8.6%).

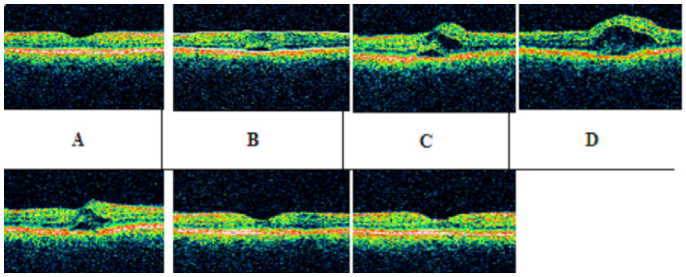

Figure 8. Macular OCT images of the patient who developed choroidal detachment (A: Preoperatively B: Postoperative 1st Day C: Day 2, D: Day 3, E: Week 1, F: 1st month, G: 1st Year)

Visual acuity, IOP values, anterior chamber depths, 1 mm diameter retinal thickness measurements in the central foveal area and the changes in the control examinations were statistically compared and the results were given in the tables and graphs below.

In the preoperative, 3rd day, 1st week, 2nd week, 1st month, 3rd month, 2nd month, 1st month, 3rd month, 6th month, 12th month, 18th month and 24th month mean OCT scores of deep sclerectomy with MMC and trabeculectomy groups no significant difference was observed (p> 0.05). There was significant alterations on mean OCT results in preoperative, 3rd day, 1st week, 2nd week, 1st month, 3rd month, 6th month, 1st month, 3rd month, 6th month, 12th month, 18th month and 24th month results of the deep sclerectomy group with MMC (p = 0.003). A statistically significant change was observed between the mean of the trabeculectomy group in preoperative, 3rd day, 1st week, 2nd week, 1st month, 3rd month, 6th month, 12th month, 18th and 24th month OCT mean (p = 0.0001) (Table 2, Figure 9)

Table 2. Comparison of OCT results

OCT	Deep Sclerectomy Group	Trabeculectomy Group	t	p
Preoperative	203.22±29.84	203.14±18.71	1.70	0.095
3rd day	204.74±28.06	206.09±21.73	-0.21	0.838
1st week	199.17±27.02	207.4±26.57	-1.15	0.257
2nd week	201.65±26.24	203.03±17.53	-0.24	0.811
1st month	202.48±26.03	200.69±15.26	0.33	0.742
3rd month	199.96±27.29	199.26±15.16	0.13	0.901
6th month	197.17±26.58	198.49±15.56	-0.24	0.813
12th month	196.74±25.35	197.71±15.7	-0.18	0.857
18th month	197.91±27.89	195.89±15.43	0.36	0.723
24th month	196.22±26.26	195.63±15.9	0.11	0.916
F	2.88	4.96		
P	0.003	0.0001		

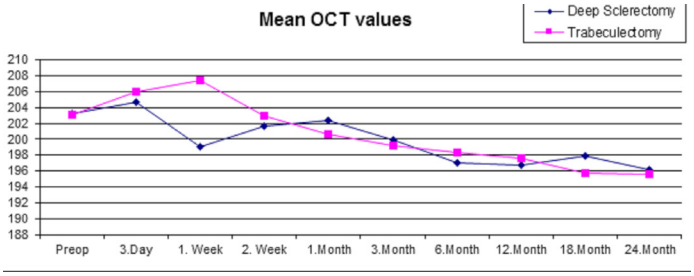

Figure 9. Comparison of mean OCT values

There was no statistically significant difference between the mean preoperative, first day, 3rd day, 1st week, 2nd week, 1st month, 3rd month, 6th month, 12th month, 18th month, 24th month IOP values of trabeculectomy and deep sclerectomy with MMC groups (p> 0.05). A statistically significant change was observed between the mean IOP values of deep sclerectomy with MMC group on preoperative, 3rd day, 1st week, 2nd week, 1st month, 3rd month, 6th month, 12th month, 18th month, and 24th month (p = 0.0001). There was a statistically significant alteration regarding IOP values on preoperative period, 3rd day, 1st week, 2nd week, 1st month, 3rd month, 6th month, 12th month, 18th month and 24th month of the trabeculectomy group (p = 0.0001) (Table 3, Figure 10).

Table 3. Comparison of IOP results

IOP	Deep Sclerectomy Group	Trabeculectomy Group	t	p
Preoperative	25.87±2.14	26.6±3.99	-0.80	0.425
1st day	10.13±3.18	10.43±4.37	-0.28	0.779
3rd day	10.57±3.2	10.63±4.53	-0.06	0.954
1st week	11.78±2.63	12.51±4.35	-0.72	0.472
2nd week	12.35±2.74	13.83±4.44	-1.43	0.159
1st month	13.65±3.96	14.14±3.31	-0.51	0.612
3rd month	12.65±2.53	14.2±2.92	-1.78	0.102
6th month	14.26±2.26	15.09±3.6	-0.98	0.332
12th month	14.35±1.61	14.89±2.54	-0.90	0.371
18th month	14.96±1.69	15.03±2.22	-0.13	0.895
24th month	15.87±1.42	15.31±2.17	1.08	0.283
F	90.67	112.41		
P	0.0001	0.0001		

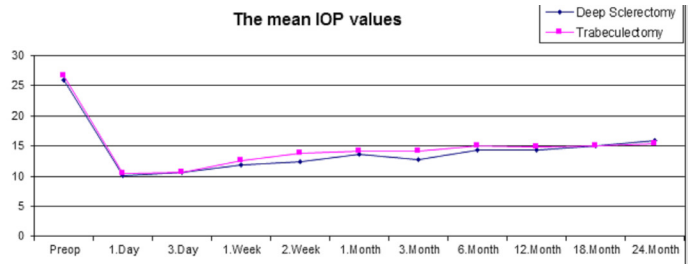

Figure 10. Comparison of mean IOP values

There was no statistically significant difference between the mean preoperative, first day, 3rd day, 1st week, 2nd week, 1st month, 3rd month, 6th month, 12th month, 18th month, 24th month anterior chamber depth values of trabeculectomy and deep sclerectomy with MMC groups (p> 0.05). A statistically significant change was observed between the mean anterior chamber depth values of deep sclerectomy with MMC group on preoperative, 3rd day, 1st week, 2nd week, 1st month, 3rd month, 6th month, 12th month, 18th month, and 24th month (p = 0.0001). There was a statistically significant alteration regarding anterior chamber depth values on preoperative period, 3rd day, 1st week, 2nd week, 1st month, 3rd month, 6th month, 12th month, 18th month and 24th month of the trabeculectomy group (p = 0.0001) (Table 4, Figure 11).

Table 4. Comparison of anterior chamber depth results

IOP	Deep Sclerectomy Group	Trabeculectomy Group	t	p
Preoperative	3.24±0.35	3.4±0.52	-1.31	0.197
1st day	2.91±0.29	2.88±0.58	0.19	0.848
3rd day	3±0.25	2.94±0.56	0.54	0.593
1st week	3.1±0.37	3.06±0.5	0.35	0.727
2nd week	3.1±0.36	3.1±0.46	-0.02	0.985
1st month	3.13±0.36	3.12±0.46	0.09	0.925
3rd month	3.14±0.38	3.1±0.45	0.31	0.757
6th month	3.14±0.38	3.12±0.46	0.20	0.845
12th month	3.15±0.38	3.12±0.45	0.23	0.823
18th month	3.15±0.35	3.12±0.45	0.22	0.825
24th month	3.15±0.37	3.13±0.45	0.12	0.905
F	5.28	11.60		
P	0.0001	0.0001		

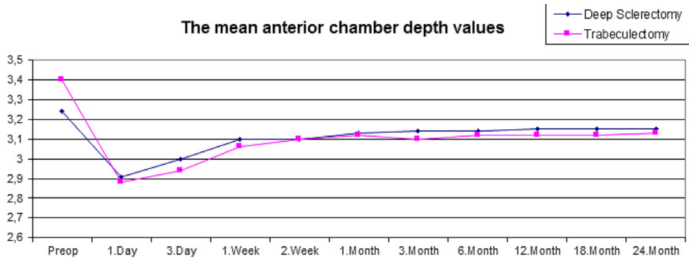

Figure 11. Comparison of mean anterior chamber depth values

There was no statistically significant difference between the mean preoperative, 1st month, 3rd month, 6th month, 12th month, 18th month, 24th month visual acuity values of trabeculectomy and deep sclerectomy with MMC groups (p> 0.05). Visual acuity values of deep sclerectomy with MMC group was significantly higher than that of the trabeculectomy group on 1st day, 3rd day, 1st week and 2nd week follow ups (p<0,05). A statistically significant change was observed between the visual acuity results of deep sclerectomy with MMC group on preoperative, 3rd day, 1st week, 2nd week, 1st month, 3rd month, 6th month, 12th month, 18th month, and 24th month (p = 0.0001). There was a statistically significant alteration regarding visual acuity results on preoperative period, 3rd day, 1st week, 2nd week, 1st month, 3rd month, 6th month, 12th month, 18th month and 24th month of the trabeculectomy group (p = 0.0001) (Table 5, Figure 12).

Table. 5. Comparison of visual acuity values

Visual acuity	Deep Sclerectomy Group	Trabeculectomy Group	t	p
Preoperative	53.48±5.98	49.09±11.5	1.69	0.098
1st day	44.3±6.79	37.66±12.16	2.38	0.021
3rd day	47.87±6.17	38.94±12.42	3.19	0.002
1st week	50.48±6.33	42.49±11.56	3.03	0.004
2nd week	51.09±6.13	45.74±11.68	2.02	0.049
1st month	52.43±6.78	47.4±11.97	1.83	0.073
3rd month	51.74±6.52	48.06±12.23	1.32	0.191
6th month	52.26±5.77	48.83±12.49	1.23	0.223
12th month	52±5.88	49.14±12.57	1.02	0.313
18th month	52.48±6.04	49.49±12.34	1.08	0.285
24th month	52.17±6.25	49.49±12.24	0.97	0.336
F	22.99	60.03		
P	0.0001	0.0001		

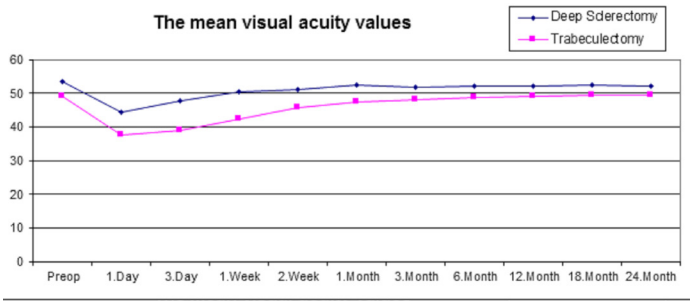

Figure 12. Comparison of mean visual acuity values

There was no statistically significant difference regarding the alterations in OCT values between preoperative and 24th month results between trabeculectomy and deep sclerectomy with MMC groups (p=0.918). There was no statistically significant difference regarding the alterations in IOP values between preoperative and 24th month results between trabeculectomy and deep sclerectomy with MMC groups(p=0.346). The difference regarding the alterations in anterior chamber depth values between preoperative and 24th month results were significantly higher in trabeculectomy group than deep sclerectomy with MMC group (p=0.05). The difference regarding the alterations in visual acuity values between preoperative and 24th month results were significantly higher in trabeculectomy group than deep sclerectomy with MMC group (p=0.05) (Table 6).

Table 6. Comparison of alterations in OCT, IOP, Anterior chamber depth and Visual acuity values between preoperative and end of study (24th month) between both groups

	Deep Sclerectomy Group	Trabeculectomy Group	MW	p
OCT	7±13.32	7.51±20.31	396	0.918
IOP	10±3	11.29±4.27	343.5	0.346
Anterior chamber depth	0.09±0.07	0.27±0.56	279	0.05
Visual acuity	1.3±3.62	-0.4±2.23	276	0.043

DISCUSSION

Glaucoma is a sneaky disease without any clinical signs that can result in blindness if un-treated. Today, glaucoma is the second cause of blindness in the world. Eight million people are thought to be bilaterally blinded by glaucoma. It is known that neural damages caused by glaucoma defined as progressive optic neuropathy are irreversible. Early diagnosis and correct treatment are of great importance in this case.

The pathogenesis and treatment of glaucoma is still controversial. Although theoretically it is thought that the reduction of IOP, improvement of ocular blood flow, and direct neuron protection will be effective in preventing glaucoma damage; nowadays, the only approach that has proven effective in preserving the visual function is by decreasing the IOP to achieve the target intraocular pressure, which is different for each individual.

There are three types of treatment in glaucoma: medical treatment, laser treatment and surgical treatment. Trabeculectomy is the most preferred treatment modality among the surgical treatment modalities, if other treatment methods fail to reach the target intraocular pressure. Trabeculectomy, first described by Cairns in 1968, was associated with less complication than other fistulizing surgical techniques at the time and more success rates in IOP control. Today, it remained as the gold standard in the surgical treatment of glaucoma. With a better understanding of the factors influencing surgical success over time, modifications of the trabeculectomy techniques and new techniques such as non-penetrating surgery have increased the reliability of surgical interventions and nowadays surgical interventions have been discussed in the early period without medical treatment (6-8).

Despite all these improvements in trabeculectomy operations, many complications can still be seen. These may sometimes cause distress in the advanced dimensions and be difficult to treat. Major complications include severe inflammation in the eye, loss of anterior chamber, hypotonia, macular edema, maculopathy, choroidal detachment, cataract and endophthalmitis. In deep sclerectomy technique, the decrease in IOP is achieved by controlled filtration of the aqueous from the thin membrane formed on the trabecular meshwork and the Descemet's membrane. Deep sclerectomy technique may prevent the previously reported complications as the anterior chamber of the eye is not inserted. However, excessive postoperative wound healing response causes fibrosis of the aqueous filtration zone that prevents the exit of the aqueous from the anterior chamber, and IOP may increase again. For this reason, a number of medications and implants have been introduced during these surgeries so that the reduction in IOP in the deep sclerectomy operations can be extended to longer periods and the success of trabeculectomy can be achieved with this technique.

In this study, we reviewed 58 eyes of 58 patients retrospectively to investigate the clinical efficacy and safety of trabeculectomy and deep sclerectomy with MMC in our clinic. We investigated the effects of both surgical techniques on IOP, visual acuity, anterior chamber depth, retinal thickness and complications.

Patients having IOP less than 21 mmHg was regarded as complete success; patients with IOP less than 21 mmHg with medication was regarded as partial success; and patients with IOP higher than 21 mmHg with medication was regarded as unsuccess. Of the 23 patients in the deep sclerectomy group with MMC, 20 patients (86.9%) had full success and 3 patients (13.1%) had partial success. In the group of trabeculectomy, complete success was achieved in 32 patients (91.4%) and partial success in 3 patients (8.6%). A statistically significant decrease in IOP was observed in both techniques. There was no statistically significant difference between two groups regarding preoperative, first day, 3rd day, 1st week, 2nd week, 1st month, 3rd month, 6th month, 12th month, 18th month, 24th month IOP levels (p> 0.05).

Shaarawy et al. reported absolute success as 55% and partial success as 89% in patients with deep sclerectomy in 33 months follow-up period (9). Ermo et al (10) evaluated the 90 eyes in which they underwent trabeculectomy, at the end of a 5-year follow-up, the full and partial success rate was 71%. Inaba et al. (11), in their studies involving 427 eyes with trabeculectomy at the end of 5-year follow-up, reported 75% complete and partial success rate. Jerndal et al. (12) reported a complete success rate of 57.3%

in the study of 330 eyes in which trabeculectomy was performed. In these four literatures, because the studies included difficult cases such as congenital and secondary glaucoma, success rates were found to be lower than our results. The fact that patients were aged 45 years or older; neovascular, uveitic and glaucoma secondary to ocular surgery were not included in this study, are the factors that increase our success rates. In addition, our follow-up time is relatively short compared to other studies, and it seems to be another factor that increases our success when considering fistula closure over time in filtering surgeries.

Although central vision and visual acuity are affected in advanced stages of glaucoma; after trabeculectomy, visual acuity may decrease due to cataract development or macular degeneration. Yıldırım et al reported the visual acuity as 0.75 ± 0.28 preoperatively and 0.79 ± 0.36 postoperatively in trabeculectomy performed 24 eyes at the end of 12 months follow-up, they also reported that in 33% of cases there was an improvement in visual acuity, in 42% of the cases there was a reduction in visual acuity and in 25% of the cases visual acuity was stable (13). Popovic and Sjöstrand, Molteno et al, Cheung et al, reported a progressive decrease in vision over time and indicated the development of cataract as the most important cause (14-16).

In our study, there was a slight decrease in visual acuity in both groups without any significant difference between groups, since there was a relatively short follow-up time and there was not enough time to develop cataract. There were no statistically significant differences between preoperative, 1st month, 3rd month, 6th month, 12th month, 18th month, and 24th month visual acuity results of deep sclerectomy with MMC and trabeculectomy groups ($p > 0.05$). The mean visual acuity in preoperative period was found to be significantly higher than the mean of visual acuity on the 1st day, 3rd day, 1st week, 2nd week, 1st month, 3rd month, 12th month, 24th month ($p = 0.046$; $p = 0.0001$).

No statistically significant difference was found regarding the mean chamber depths on preoperative, 1st day, 3rd day, 1st week, 2nd week, 1st month, 3rd month, 6th month, 12th month, 18th month, 24th month ($p > 0.05$) between deep sclerectomy with MMC and trabeculectomy groups. The mean preoperative -24th anterior chamber depth differences of the trabeculectomy group were found to be significantly higher than the deep sclerectomy group with MMC ($p = 0.05$). In other words, more anterior chamber depth loss was observed in the trabeculectomy group. When both groups were evaluated separately, a statistically significant decrease in anterior chamber depth was observed in both groups. The maximum loss was observed on the 1st and 3rd days after surgery.

Goins and colleagues measured the anterior chamber depths of the 14 patients who underwent trabeculectomy; reported that they had reached preoperative values on the 14th day following a decrease on the 1st and 2nd days after the operation (17). Peng and his colleagues measured the anterior chamber depths of 33 eyes in 26 patients who underwent trabeculectomy; there was a significant decrease on days 2 and 4, there was a deepening in the anterior chamber from 5th day on, and reported that the preoperative values were reached in 91% on day 14, and in 93% on the day 30 (18).

No significant difference was observed regarding the mean OCT scores in the preoperative, 3rd day, 1st week, 2nd week, 1st month, 3rd month, 6th month, 12th month, 18th month and 24th month periods between trabeculectomy and deep sclerectomy with MMC groups ($p > 0.05$). When both groups were examined separately, a slight increase was observed in the postoperative measurements of OCT in both groups, and pre-operative values were reached on the first week and after 1st week the values were lower than the preoperative values.

Klink et al. found hypotonia in 8 eyes of 13 patients who underwent trabeculectomy. They reported that their foveal thickness increased in OCT measurements and foveal thickness improved with hypotonia repair. They reported that loss of vision seen after hypotonia was due to foveal thickness increase (19).

Karasheva et al performed trabeculectomy in 45 eyes of 45 patients; they measured foveal macular thickness and anterior chamber depth with OCT on preoperative period, in 2nd day, 1st week, 1st. month, 3 months. They reported that foveal thickness increased on day 2, week 1, and 1st month, and reached to the preoperative levels at 3rd month and there was no significant change in anterior chamber depth (20).

In many studies comparing deep sclerectomy with trabeculectomy, it is stated that absolute success is better in trabeculectomy group and there is no significant difference in success rates. When the complication rates are compared, it is stated that the rates of complications of deep sclerectomy are significantly less.

In our study, deep sclerectomy with MMC operations were completed without any complications, while in the trabeculectomy group 2 patients (5.7%) had hemorrhage in the anterior chamber during surgery. In both patients, viscoelastic material was administered to the anterior chamber and the bleeding was controlled. Hyphema was not observed postoperatively.

Postoperative hypotonia was detected in 2 patients (8.7%) in the deep sclerectomy group with MMC. In one of these cases, IOP values were determined as 4 mmHg on the 1st and 3rd days; no hypotonia was observed in the control examinations following the first week. In the other patient, IOP was determined as 5 mmHg on the 1st and 3rd days; no hypotonia was observed in the control examinations following the first week. Since anterior chamber was not defected in both patients, patients were followed up without any interventions.

In the trabeculectomy group, 5 patients (14.3%) had hypotonia, 2 patients (5.7%) had shallow anterior chamber

and 1 patient (2.85%) had choroidal detachment. A tight bandage was performed on 2 patients with shallow anterior chamber. Anterior chamber preservation was achieved in both patients at day 3 and no hypotonia was observed at the end of the first week. The patient with choroidal detachment was treated with strict bandage. While no hypotonia was observed at the 1st week, choroidal detachment was not observed in the first month control.

Deep sclerectomy with MMC is still defined as an effective and reliable technique in recent studies. Al-Obeidan et al retrospectively examined 194 eyes of 152 patients with primary open angle glaucoma who underwent deep sclerectomy with MMC. In this study with a mean follow-up of 60.9 ± 49.7 months, they reported a significant decrease in IOP and a low complication rate (21). Suominen and colleagues followed up for 12 months 37 eyes of 37 patients with normotensive glaucoma who underwent deep sclerectomy and in this prospective study they found deep sclerectomy operation to be effective and reliable. They also found that IOP decreased more in cases undergoing MMC (22). Karakurt et al retrospectively examined 52 eyes of 48 patients with pseudoexfoliative glaucoma and cataract who underwent deep sclerectomy combined with phacoemulsification. The mean follow-up time was 46.4 ± 12.8 months and they found that deep sclerectomy operation was effective and safe in the long term in terms of decreasing IOP, decreasing the number of drugs and increasing visual acuity (23). Harju et al investigated 37 patients with normotensive glaucoma who underwent deep sclerectomy in a prospective study. The mean follow-up time was 7.9 (1.0- 9.0) years and they found a significant decrease in IOP and a low rate of complications (24). Ollikainen and colleagues prospectively examined 68 eyes of 68 patients with primary open angle glaucoma and pseudoexfoliative glaucoma who underwent deep sclerectomy with MMC. In this study with a mean follow-up of 3 years, in both glaucoma groups, they found deep sclerectomy with MMC operation was defined to be effective and safe (25). In a study of Mercieca and colleagues who underwent deep sclerectomy combined with phacoemulsification, 296 eyes of 282 patients were retrospectively analyzed. In this study with a mean follow-up period was 63.5 ± 35.3 months, deep sclerectomy combined with phacoemulsification was found to be effective and safe in long term (26). Özsoy et al prospectively studied 20 eyes of 20 patients with open angle glaucoma who underwent deep sclerectomy. In this study, which has a mean follow-up of 6 months, it was found that deep sclerectomy surgery significantly decreased IOP and increased ocular perfusion pressure and retrobulbar blood flow (27).

In a prospective study by Igor L et al, 34 eyes with severe and end-stage glaucoma who underwent deep sclerectomy was followed for an average of 29 (6-54) months. They found that the sclerectomy operation provided stabilization in the central 10 ° visual field and even provided some improvement if not statistically significant (28).

Studies have shown that deep-sclerectomy is an effective and reliable method in patients with steroid-induced glaucoma in the presence of an accompanying inflammatory eye disease such as uveitis and in patients undergoing penetrating keratoplasty (29-31).

CONCLUSION

In the light of all the results obtained in our study; although there was no statistically significant difference between the two surgical techniques in terms of success, complications were higher in the trabeculectomy group. The most important reason for this is the entrance into the anterior chamber during surgery. Although deep sclerectomy technique is difficult to apply and the learning period is long; it seems to be an important alternative to trabeculectomy operations as it has a significant advantage such as not entering through the anterior chamber.

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