

Comparison of the Clinical Results of Combined Phacoemulsification and Deep Sclerectomy with the Use of Mitomycin C at Different Sites

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ABSTRACT

To evaluate the clinical results combined phacoemulsification and deep sclerectomy (PDS) with the use of mitomycin C (MMC) at different sites. PDS with MMC was performed in patients with open angle glaucoma and cataract. The patients were divided into two groups. In 16 eyes of the first group, MMC (0.2 mg/ml) was applied to subconjunctival area and under the superficial scleral flap. In 16 eyes of the second group, MMC was applied only to the place under the superficial scleral flap. It was compared the effects of different MMC applications in between the groups. Preoperative mean intraocular pressure (IOP) was significantly decreased from 25.84±3.78 mmHg to 16.34±3.33 mmHg ($p<0.001$). Preoperative best corrected visual acuity (BCVA) was improved from 0.2 to 0.7. Complete final success rates were 67.3% in the first group and 54.2% in the second group. The most common MMC dependent complication was avascular bleb formation which was seen in 5 eyes (31.25%) of the first group and 2 eyes (12.5%) of the second group. Cystic bleb formation was seen in one eye of the second group. The differences in both success rates and complications were statistically significant ($p<0.05$). MMC is more effective when it is applied to the subconjunctival area together with the place under the superficial scleral flap. However this procedure increases the rate of complications such as avascular bleb formation.

Key words: Glaucoma, cataract, deep sclerectomy, phacoemulsification, mitomycin C.

Fakoemulsifikasyon ile Kombine Derin Sklerektomide Farklı Alanlara Uygulanan Mitomisin C'nin Klinik Sonuçlarının Karşılaştırılması

ÖZET

Fakoemulsifikasyon ile kombine derin sklerektomide (FDS) farklı alanlara uygulanan Mitomisin C'nin (MMC) klinik sonuçlarının değerlendirilmesi. Primer açık açılı glokom ile birlikte kataraktı olan hastalara MMC'li FDS ameliyatı yapıldı. Hastalar iki gruba ayrıldı. İlk gruptaki 16 göze, MMC (0,2 mg/ml) subkonjonktival alana ve yüzeysel skleral flebin altına uygulandı. İkinci gruptaki 16 göze ise bu uygulama sadece yüzeysel skleral flep altına yapıldı. Farklı MMC uygulamalarının iki gruptaki etkileri karşılaştırıldı. Bütün gözler ele alındığında ortalama preoperatif GİB antiglokmatöz medikasyon ile 25,84±3,78 mmHg iken postoperatif son kontrollerde ortalama GİB 16,34±3,33 mm Hg idi ($p<0,001$). Preoperatif dönemde en iyi düzeltilmiş görme keskinliği (EİDGK) ortalama 0,2 iken postoperatif dönemde 0,7 idi. Tam başarı oranları birinci grupta %67,3; ikinci grupta ise %54,2 idi. MMC'ye bağlı olarak görülen en sık komplikasyon avasküler bleb gelişimi idi. Birinci grupta beş gözde (% 31,25) avasküler bleb görüldü. İkinci grupta ise iki gözde (%12,5) avasküler bleb görüldü. İkinci grupta bir hastada kistik bleb görüldü. Bu iki grup karşılaştırıldığında başarı ve komplikasyon oranlarındaki farkın istatistiksel olarak anlamlı olduğu görüldü ($p<0,05$). Yüzeysel skleral flep altına ek olarak subkonjonktival alana uygulanan MMC, cerrahinin başarısını artırırken daha fazla avasküler bleb gelişimine neden olmaktadır.

Anahtar kelimeler: Glokom, katarakt, derin sklerektomi, fakoemulsifikasyon, mitomycin C

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INTRODUCTION

In patients with open angle glaucoma and cataract; control of intraocular pressure (IOP) without medication while improving best corrected visual acuity (BCVA) increases quality of life. Deep sclerectomy and its modifications are nonpenetrating glaucoma surgery (NPGS) that refers to drainage of aqueous humor through a natural intact membrane, namely the trabecular meshwork (1,2). This procedure was first performed by Epstein and Krasnov in the late 1950s and early 1960s. Epstein described an operation that consisted of paralimbal deep sclerectomy overlying schlemm's canal, over 180°, without entering the anterior chamber (3). In 1968, Krasnov described an operation and called it "sinusotomy". He suggested unroofing schlemm's canal without entering anterior chamber (4). Early results of these operations were successful. But the longevity of effective filtration with these methods was as short as a few months due to scarring of the conjunctiva over the bare trabecular membrane. New studies were focused on this new technique to increase its success rates. Some investigators suggested performing deep sclerectomy under a superficial scleral flap (5-8). The results of this new technique were better. But again success rates were decreasing in long term. After filtration surgery; proliferation of Tenon capsule fibroblasts cause fibrosis of the bleb and surrounding tissue and decrease the efficacy of the surgery. To avoid this phenomenon the application of antimetabolites has been studied (9, 10). Mitomycin C (MMC) and 5-fluorouracil (5-FU) are the antimetabolites that are most commonly used.

In this study we evaluated the efficacy and safety of combined phacoemulsification and PDS with the MMC in patients with medically uncontrolled open angle glaucoma and cataract.

MATERIALS AND METHODS

This study is retrospective, comparative, and non-randomized case series. Thirty-two eyes of 29 adult patients with medically uncontrolled open angle glaucoma and grade 2-4 cataract undergoing combined phacoemulsification and PDS with the use of MMC between January 2005 and June 2007 were included. PDS procedures were divided into two groups. In the first group (16 eyes), MMC (0.2 mg/ml) was applied to subconjunctival area and under the superficial scleral flap. In 16 eyes

of the second group, MMC was applied only to the place under the superficial scleral flap. Preoperative baseline data included best corrected visual acuity assessment, applanation tonometry, anterior biomicroscopy, gonioscopy, fundus examination, automated perimetry using Humphrey Field Analyzer. After surgery except for visual fields, the same examinations were performed at day 1, 7 and 1, 2, 3, 4, 5, 6 and every 3 months thereafter until the final examination. Nd: YAG Laser goniopuncture was performed in a case that has an IOP greater than 20 mmHg. If it was not effective to control IOP than glaucoma medication prescribed.

Indications for surgery included patients with uncontrolled primary open-angle glaucoma with uncontrolled IOP and progressive visual field defects while receiving maximal tolerable antiglaucoma therapy and visually significant cataract. Excluded from the study were patients with angle-closure glaucoma, post-traumatic, uveitic, neovascular, or dysgenetic glaucoma. Patients with a history of previous ocular surgery were also excluded from the study. Groups were quite well matched whether regarding to the mean age, history of cataract, preoperative IOP, the level of glaucomatous optic disc damage, or the duration of medical treatment. (Wilcoxon W $p > 0.05$).

Possible alternatives, beneficial effects, and potential complications of the surgical procedure were explained in detail to all patients. Written informed consent was obtained from all participants.

All operations were performed by the same surgeon. After administering subtenon anesthesia (2% Lidocaine, preparat, firma, üretim yeri??), the procedure was started with the creation of a fornix-based conjunctival flap in the superior quadrant and the sclera was exposed. A one third scleral thickness limbus based scleral flap measuring 5x5 mm was dissected. In the first group, a sponge soaked with MMC (0.2 mg/ml) (preparat, firma, üretim yeri??), was applied to subconjunctival area and beneath the scleral flap during two minutes. After two minutes the dissection area was irrigated with balanced salt solution. In the second group, MMC was applied only beneath the scleral flap (Figure 1). A second limbus-based deep scleral flap measuring 4x4 mm was dissected beneath the previous one towards the choroid. After phacoemulsification and in-the-bag implantation of a hydrophobic acrylic intraocular lens, the dissection of deep scleral flap was carried down to unroof and

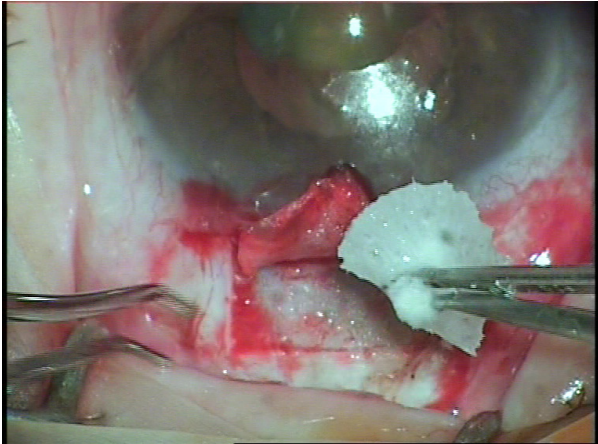


Figure 1. MMC application beneath the superficial scleral flap

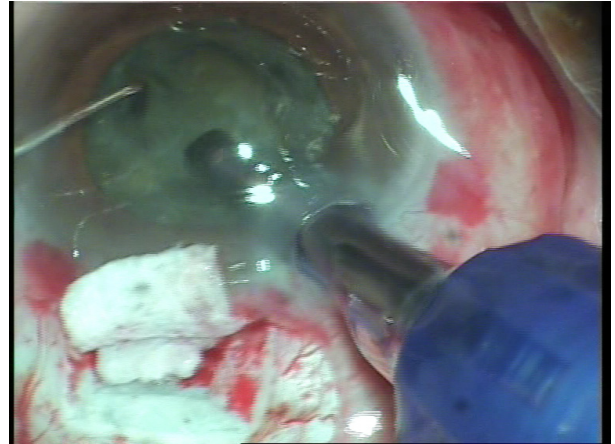


Figure 2. Phacoemulsification after dissection of deep scleral flap

remove Schlemm’s canal and juxtacanalicular trabeculum (Figure 2). Anteriorly excision of corneal stroma was carried down to Descemet’s membrane. Aqueous humor was seen to percolate through the trabeculo-descemetic membrane. At this stage, deep scleral flap was excised (Figure 3). Scleral flap was closed with 10-0 monofilament nylon sutures in cases with micro perforation. In cases with no micro perforation scleral flap was closed without sutures. The conjunctiva was closed with 10-0 nylon sutures. Postoperative management included topical treatment with dexamethasone 0.1% (preparat, firma, üretim yeri??), and ofloxacin 0.3% (preparat, firma, üretim yeri??), four times daily for one week fol-

lowed by dexamethasone 0.1% for at least another one months. Surgical success was defined as an IOP less than 21 mmHg with no adjunctive medication or surgery. Incomplete success was defined as on IOP less than 20 mmHg with only one glaucoma medication or Nd: YAG laser goniopuncture application. Failure was considered when target IOP was reached with more than one medication or when further glaucoma surgery was required. Mann-Whitney U and Wilcoxon W tests for comparison of means, Pillai’s Trace test for postoperative IOP comparison between groups were used. A p-value <0.05 was considered as significant.

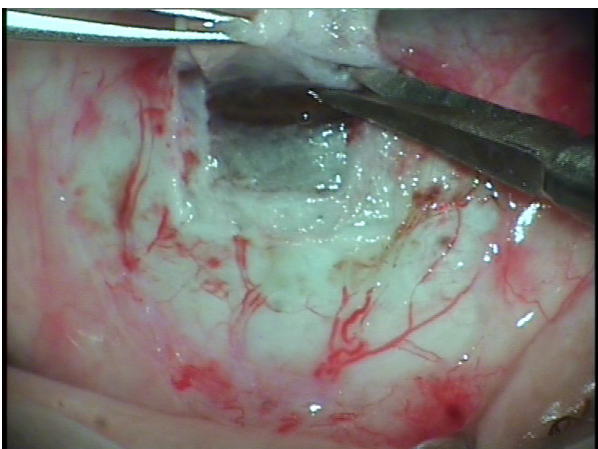


Figure 3. Excision of deep scleral flap

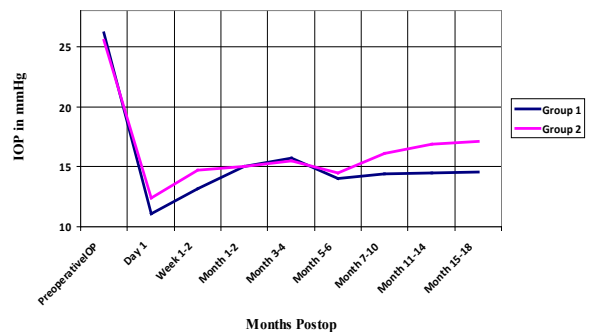


Figure 4. IOP changes after surgery

Table 1. Perioperative characteristics of patients

	First Group ¹	Second Group ²	p-value
Number of eyes	16	16	p>0.05
Age in years (SD)	61.40±8.24	57±7.27	p>0.05
Follow-up (Months)	18.05±2.7	18.61±3.7	p>0.05
Preoperative Medications	2.4±0.51	2.0±0.95	p>0.05
Duration of Preoperative Medication Use (Months)	48.70±14.26	45.87±13.56	p>0.05
Preoperative IOP (mmHg) (SD)	26.18±3.86	25.5±4.23	p>0.05

SD=standart deviation, ¹MMC was applied to subconjunctival area and under the superficial scleral flap. ²MMC was applied only to the place under the superficial scleral flap.

RESULTS

Regarding patients demographic and preoperative properties, there was no statistically significant difference between groups (Table 1). Preoperative mean IOP was significantly decreased from 25.84±3.78 mmHg to 16.34±3.33 mmHg ($p<0.001$) (bu postop hangi zamandaki değer). Preoperative BCVA was improved from 0.2 to 0.7 (postop hangi zamandaki değer). There was no significant difference in the improvement of visual acuity between the two groups. A decrease of two Snellen chart lines from preoperative BCVA was observed in 3 eyes (9.37%) (postop hangi zamandaki değer). (The causes were age-related macular degeneration in two eyes and retinal vein occlusion in one eye.) Bu cümle zor anlaşılıyor. Complete final success rates at 18 months were 67.3% in the first group and 54.2% in the second group ($p<0.05$). Incomplete success rates were 73.5% in the first group and 65.3% in the second group ($p<0.05$). IOP changes after surgery for the two groups are shown in Figure 4. The difference between preoperative mean IOP and postoperative final mean IOP in the first group was 11.59 mmHg. In the second group it was 7.41. The difference of final mean IOP between groups was 3.5 mmHg and it was clinically and statistically significant ($p<0.05$). There was a significant decrease in the mean

number of medications required to control IOP from 2.4±0.51 before and 0.8 ±0.1 after surgery in the first group and 2.0±0.95 before and 0.9 ±0.1 after surgery in the second group (postop hangi zamandaki değer). The difference between groups was not statistically significant ($p>0.05$). Nd: YAG laser goniopuncture was performed to 5 cases (31.25%) in the first group and 6 cases (37.5%) in the second group between 3 and 6 months (mean 3.1± 2.4 months). The difference between groups was not statistically significant ($p>0.05$).

Surgical complications are shown in Table 2. Avascular bleb formation was seen in five eyes (31.25%) in the first group and two eyes (12.5%) in the second group ($p<0.05$). Cystic bleb formation was seen in one eye in the second group. On the other hand no cystic bleb formation was seen in the first group.

DISCUSSION

Deep sclerectomy is a nonpenetrating glaucoma surgery (NPDS) used in the treatment of open angle glaucoma. When compared with the conventional trabeculectomy, NPDS does not produce any significant postoperative hypotony with choroidal detachment and subsequent cata-

Table 2. Surgical complication rates

	First Group ¹	Second Group ²	p-value
Number of eyes	16	16	>0.05
HypHEMA	1 (%6.25)	0	>0.05
Fibrin in anterior chamber	0	1 (%6.25)	>0.05
Avascular bleb	5 (31.25%)	2 (12.5%)	<0.05
Cystic bleb	0	1 (%6.25)	>0.05
Transient conjunktival leak	26.18±3.86	25.5±4.23	>0.05

¹MMC was applied to subconjunctival area and under the superficial scleral flap. ²MMC was applied only to the place under the superficial scleral flap.

ract formation owing to flattening of anterior chamber (11-14). After filtration surgery; proliferation of Tenon capsule fibroblasts cause fibrosis of the bleb and decrease efficacy of the surgery. To increase efficacy of the surgery new techniques are developed (10,15,16). MMC application is one of these techniques that we investigated in our study. The efficacy of MMC can be explained with three different mechanisms. First mechanism is about wound healing. Khaw et al showed that MMC stops fibroblast growth for 30 days after surgery (17). Second mechanism is changes in structure and decrease in number of subconjunctival tissue cells. Third mechanism is toxic effects of MMC on ciliary body and decrease in production aqueous humor. Nuyts et al reported MMC caused vascular endothelial damage (18). MMC is used frequently in glaucoma surgery in order to enhance the passage of aqueous from anterior chamber to subconjunctival space and to lower the risk of scleral fibrosis (10, 17-20) . However the use of MMC is associated with some adverse effects such as bleb leaks, infection, severe hypotony and irreversible maculopathy (20, 21). In order to decrease the risk of potential complications it is important to know the exact dose, place and timing of the application. In this study we evaluated the place of MMC application.?? We compared the clinical results, efficacy and safety of combined phacoemulsification and PDS with the use of MMC at different sites. In the first group, the place where MMC was applied was subconjunctival area and under the superficial scleral flap. In the second group, MMC was applied only to the place under the superficial scleral flap. So the difference between groups was that, MMC was also applied to conjunctiva in the first group while it was not in the second group.

After PDS, aqueous humor percolates through the trabeculo-desmotic membrane and it is collected in the intrascleral bleb, and then it is reabsorbed from the subconjunctival, intrascleral and subchoroidal regions (22). For the success of the surgery the maintenance of the patency of the intrascleral space is a major concern. On the other hand, after filtration surgery, proliferations of Tenon capsule fibroblasts cause fibrosis of the bleb and surrounding tissue; decreasing the efficacy of the surgery. Intra-operative application of MMC in the center of the deep sclerectomy dissection had been proposed in order to enhance the passage of aqueous from the anterior chamber to the subconjunctival space and to lower the risk of scleral fibrosis (10,17-20). This proposal was

proven once again in our study. Complete final success rates were 67.3% in the first group and 54.2% in the second group. The difference was statistically significant which means that MMC application to subconjunctival space increases the efficacy of the surgery. On the other hand, the observed complications were higher in the first group. Avascular bleb formation was seen in five eyes (31.25%) in the first group and two eyes (12.5%) in the second group.

What this study indicates is that PDS with the use of MMC is an effective and relatively safe procedure when performed in patients open angle glaucoma and cataract.?? We can conclude that the IOP results and the success rates were better when MMC was applied in the subconjunctival area and under the superficial scleral flap. However, complication rates in this application were seem to be higher than MMC application under the superficial scleral flap only.??

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