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Outcomes of Combined 25 G Transconjunctival Sutureless Vitrectomy and Femtosecond Laser Assisted Cataract Surgery in Patients with Cataract and Vitreoretinal Disorders

Katarakt ve Vitreoretinal Bozuklukları Olan Hastalarda Kombine 25 G Transkonjonktival Sütürsüz Vitrektomi ve Femtosaniye Lazer Yardımlı Katarakt Cerrahisinin Sonuçları

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ABSTRACT Objective: To evaluate the outcomes of 25 gauge pars plana vitrectomy combined with Femtosecond laser-assisted cataract surgery in various vitreoretinal disorders. **Material and Methods:** 30 eyes of 30 patients who were operated in the Batigoz Eye Health Center due to mild to moderate cataract and various retinal disorders between the period of September 2014 and April 2017 were reviewed. Visual acuity before and after surgery was evaluated. In addition, complications that occurred in patients were recorded. **Results:** Mean age of patients was 61.3±13.4 years. 14 of the patients were female and 16 were male. The mean follow-up period of the patients was 8.53 ± 2.04 months (range from 5 to 12). The indications for phacovitrectomy were epiretinal membrane (54%), vitreous haemorrhage (20%) and macular hole (26%). Visual acuity after surgery increased by at least 3 lines in all eyes. Mean preoperative and postoperative best-corrected visual acuity with logMAR were 0.76±0.73 and 0.11± 0.11, respectively (p=0.000). Posterior capsule opacification occured in 2 eyes (6.6%). No other complications were encountered. **Conclusions:** Femtosecond laser-assisted cataract surgery combined with 25 gauge pars plana vitrectomy is a reliable and fast solution for patients with mild to moderate lens opacities and vitreoretinal pathology.

Keywords: Cataract; vitreoretinal surgery

ÖZET Amaç: Çeşitli vitreoretinal bozukluklarda Femtosaniye lazer yardımlı katarakt cerrahisi ile kombine edilen 25 gauge pars plana vitrektomi sonuçlarını değerlendirmek. **Gereç ve Yöntemler:** Eylül 2014-Nisan 2017 dönemi arasında hafif ila orta derecede katarakt ve çeşitli retinal bozukluklar nedeniyle Batigöz Göz Sağlığı Merkezi'nde ameliyat edilen 30 hastanın 30 gözü incelendi. Ameliyat öncesi ve sonrası görme keskinliği değerlendirildi. Ayrıca hastalarda ortaya çıkan komplikasyonlar kaydedildi. **Bulgular:** Hastaların yaş ortalaması 61,3±13,4 yıl idi. Hastaların 14'ü kadın, 16'sı erkek idi. Hastaların ortalama takip süresi 8,53±2,04 ay (5-12 ay) idi. Fakovitrekomi endikasyonları epiretinal membran (%54), vitreus hemorajisi (%20) ve maküler delik (%26) idi. Ameliyat sonrası görme keskinliği tüm gözlerde en az 3 sıra arttı. LogMAR ile operasyon öncesi ve sonrası ortalama en iyi düzeltilmiş görme keskinliği sırasıyla 0,76±0,73 ve 0,11±0,11 idi (p=0,000). İki gözde (%6,6) arka kapsül opasitesi oluştu. Başka komplikasyonlara rastlanmadı. **Sonuç:** Femtosaniye lazer yardımlı katarakt cerrahisi ile kombine 25 gauge pars plana vitrektomi, hafif ila orta derecede lens opasitesi ve vitreoretinal patolojisi olan hastalar için güvenilir ve hızlı bir çözümdür.

Anahtar Kelimeler: Katarakt; vitreoretinal cerrahi

Vitrectomy is a surgical procedure of the posterior part of the eye. Cataract development after this procedure is not a rarity. Surgery of the developed cataract after vitrectomy has got a higher incidence of complications.[1] The presence of cataract often requires a second operation after vitreoretinal surgery if lens extraction is not performed during vitreoretinal surgery. In addition, vitrectomy itself can increase cataract pro-

gression.[2] Therefore, phacoemulsification at the same time during vitrectomy is suggested in order to increase the likelihood of postoperative improvement in visual acuity (VA), to provide a better view of the retina intraoperatively, and to improve visualization of the retina postoperatively.[3] Femtosecond laser-assisted cataract surgery (FLACS) has been recently introduced into surgical practice. The advantage of FLACS is the reducing of the risks of manual capsulorhexis, decreases phacoemulsification time, decreases IOL manipulation, tilting and decentration, lesser energy for the phacoemulsification, the repeatability of the anterior capsulorhexis and a greater reduction in endothelial count loss.[4,5] Several studies have been published in the literature as regards combined phacovitrectomy.[2,3,6,7] In these studies, however, pars plana vitrectomy (PPV) has performed with 20 or 23 gauge (G). To our knowledge, there are no studies showing the outcomes of FLACS combined with 25 G PPV surgery in the literature. Therefore, this study aimed to demonstrate the outcomes and complications of femtosecond laser-assisted 25 G phacovitrectomy in our clinic.

MATERIAL AND METHODS

The medical records of all patients treated at the Batigoz Eye Health Center using a combined technique of FLACS and PPV with 25-gauge instruments between September 2014 and April 2017 were evaluated. All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration. Informed consent was obtained from all patients who were enrolled into the study.

Preoperative data collected were: age, gender, medical history, refraction and best corrected visual acuity (BCVA), intraocular pressure (IOP), slit-lamp biomicroscopy, fundus examination with contact lens or indirect ophthalmoscopy, type and extent of cataract and vitreoretinal disease. B-scan ultrasonography, spectral-domain optical coherence tomography (SD-OCT) was performed according to their condition.

Patients with previous retinal detachment, intravitreal inflammation due to posterior uveitis primary or secondary glaucoma and underwent intraocular surgery were not included into the study. The lens opacity was assessed according to the Lens Opacities Classification System III (LOCS III) under slit lamp examination by one investigator.[8] Only patients with a cataract with grade 1 or more were operated with this technique.

SURGICAL TECHNIQUE

The complete surgical procedure was carried out in the same operating room. In a first procedure, femtosecond laser-assisted cataract surgery was performed (Alcon, LenSx; Forth Worth, TX) under topical anesthesia and peribulbar block and sedation. The diameter of the anterior capsulorhexis was chosen depending on the surgical indication, 4.8 mm in cases where the use of a gas tamponade was expected, (e.g. macular hole) and 5 mm in all other cases. An aspheric, hydrophobic acrylic, foldable, one-piece IOL was used, with an optical area diameter of 6 mm. As a second step, after preparing the surgical field, the surgeon (U.Ü.) opened the corneal incisions with a spatula and introduced viscoelastic device to maintain the anterior chamber. The anterior capsule was then extracted with forceps. Hydrodissection, phacoaspiration of the nucleus and irrigation-aspiration of the masses were performed. Finally, using an injector, a foldable monobloc intraocular lens (IOL) was implanted into the capsular bag without a viscoelastic device. Subsequently, the surgeon (U.Ü.) placed three valved 25-gauge microcannulas 3.5 mm away from the limbus, with the infusion cannula inserted through the inferotemporal quadrant. Vitrectomy was performed using the Alcon Constellation (Forth Wort, TX) Combined Phacovitrectomy System. Depending on the present vitreoretinal lesion, epiretinal membrane (ERM) and internal limiting membrane peeling, laser endophotocoagulation and/or cryotherapy with or without fluid-gas exchange was applied. The peripheral retina was then reviewed with indentation to locate any possible iatrogenic break (Figure 1).

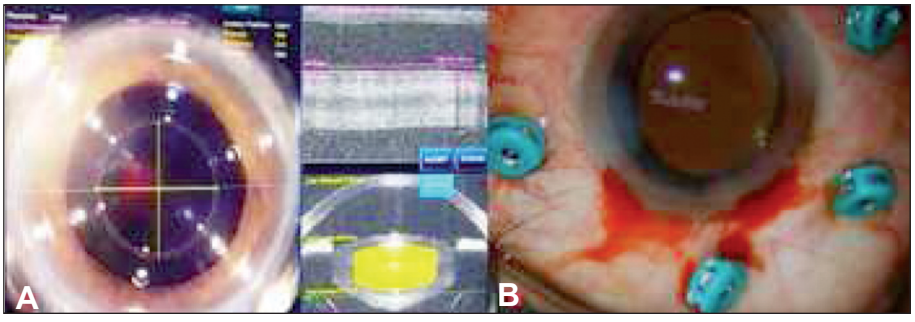

FIGURE 1: Intraoperative photographs of the anterior segment. **A)** Adjustment of diameter of the anterior capsulorhexis at the LenSx femtosecond laser system, **B)** Placement of 25 G microcannulas after femtosecond laser-assisted cataract surgery.

Finally, the microcannulas were removed, the scleral perforated places sutured and cefuroxime was injected into the anterior chamber (vancomycin was used if the patient was allergic to penicillin).

The patients were evaluated at postoperative first day, first week, second week and first month, and then the examination was repeated every month. Only the last visit results are announced here. Every complication or visual decrease was noted on each visit.

STATISTICAL ANALYSIS

The results were analyzed with Statistical Package for Social Sciences for Windows version 15.0 (SSPS Inc., Chicago, Ill., USA). BCVAs in logMAR (logarithm of the minimum angle of resolution) notation were the main data used for the statistical analysis. Data were compared with the paired t test. A p value of <0.05 was considered to be statistically significant.

RESULTS

14 of the 30 patients were female and 16 were male. Mean age was 61.3 ± 13.4 years. The mean follow-up period was 8.53 ± 2.04 months (range from 5 to 12). The most common indication for phacovitrectomy was epiretinal membrane (54%). The other indications were vitreous haemorrhage (20%) and macular hole (26%). Detailed information as regards surgical indications, preoperative and postoperative visual acuity levels are given in Table 2. The mean LOCS III grade was 2.3 ± 0.59 (range, 1-3). Mean preoperative BCVA was 0.76 ± 0.73 (range from 0.3 to 3.0) and mean postoperative BVCA was 0.11 ± 0.11 (range from 0.0 to 0.4). The difference between preoperative and postoperative visual acuity values was statistically significant (p = 0.000). The BCVA was increased at least 3 lines in all patients after surgery at the final visit. In 22 patients (63%) the final BCVA was 0.1 or better. In none of the cases, neither during the operation nor in the postoperative period was encountered serious complication such as loss of cone-suction or iatrogenic retinal tear development. The mean preoperative and postoperative IOP were 14.43 ± 2.01 mmHg (range, 11-19) and 14.96 ± 2.87 mmHg (range, 11-25), respectively (p=0.118). The increase in IOP at the postoperative period was detected in 2 patients (6.6%) (23 and 25 mmHg). The IOP was controlled by antiglaucoma agent (dorzolamide hydrochloride 2%-timolol maleate 0.5%) and the agent was discontinued 5 days after the surgery. Posterior capsule opacification (PCO) developed in 2 patients (6.6%) 3 months after the surgery. They were treated with Nd-YAG capsul= otomy 6 months after the surgery. The clinical characteristics, diagnosis of the patients, and surgical procedures were summarized in tables (Tables 1 and 2). No complications were observed in the postoperative period. The macular hole was closed in all eyes (n=8). In all cases with epiretinal membrane (n=16), morphological improvement (normal retinal contour and formation of foveal depression) was obtained by PPV with internal limiting membrane peeling.

TABLE 1: Patients demographics and clinical characteristics.

Female/Male	14/16
Mean age (Years)	61.3 ± 13.4 (range, 47-78)
Mean follow up (month)	8.53 ± 2.04 (range, 5-12)
Preoperative BCVA (LogMAR)	0.76 ± 0.73 (range, 0.3-3.0)
Postoperative BVCA (LogMAR)	0.11± 0.11 (range, 0.0-0.4)

Values are shown as mean ± standard deviation.
Abbreviations: BCVA, best corrected visual.

DISCUSSION

Phacoemulsification combined with PPV is not a new procedure. It has been performed in the world since more than 10 years.[6-11] Although some authors have reported as mild, cataract progression after single vitrectomy is often encountered problem between 6-12 months after surgery.[12,13] This problem leads to find a solution to spare the patient and the medical staff from a second surgery and its

TABLE 2: Patients diagnosis, surgical procedures, preoperative and postoperative visual acuity values.

Patient's Diagnosis	Surgical Prosedures	Preoperative BCVA (LogMAR)	Postoperative BCVA (LogMAR)
MH	FLACS+25 G PPV+ILM P+SF 20%	0.3	0.0
VH	FLACS+25 G PPV+PRP+IVTA	3.0	0.4
ERM	FLACS+25 G PPV+ERM/ILM P	0.3	0.0
ERM	FLACS+25 G PPV+ERM/ILM P +IVTA	0.6	0.1
MH	FLACS+25 G PPV+ILM P+SF 20%	0.5	0.1
VH	FLACS+25 G PPV+PRP+IVTA	2.0	0.2
ERM	FLACS+25 G PPV+ERM/ILM P	0.5	0.0
MH	FLACS+25 G PPV+ILM P+SF 20%	0.4	0.0
ERM	FLACS+25 G PPV+ERM/ILM P	0.7	0.2
VH	FLACS+25 G PPV+PRP+IVTA	2.0	0.3
ERM	FLACS+25 G PPV+ERM/ILM P +IVTA	0.4	0.0
ERM	FLACS+25 G PPV+ERM/ILM P	0.6	0.2
ERM	FLACS+25 G PPV+ERM/ILM P	0.4	0.1
ERM	FLACS+25 G PPV+ERM/ILM P +IVTA	0.3	0.0
VH	FLACS+25 G PPV+PRP+IVTA	3.0	0.4
VH (PDR)	FLACS+25 G PPV+PRP+IVTA	1.0	0.1
ERM	FLACS+25 G PPV+ERM/ILM P	0.3	0.0
ERM	FLACS+25 G PPV+ERM/ILM P	0.5	0.0
MH	FLACS+25 G PPV+ILM P+SF 20%	0.6	0.1
ERM	FLACS+25 G PPV+ERM/ILM P	0.3	0.0
MH	FLACS+25 G PPV+ILM P+SF 20%	0.5	0.1
ERM	FLACS+25 G PPV+ERM/ILM P	0.4	0.1
VH (PDR)	FLACS+25 G PPV+PRP+IVTA	1.0	0.3
ERM	FLACS+25 G PPV+ERM/ILM P	0.5	0.2
ERM	FLACS+25 G PPV+ERM/ILM P	0.4	0.1
MH	FLACS+25 G PPV+ILM P+SF 20%	0.4	0.1
ERM	FLACS+25 G PPV+ERM/ILM P +IVTA	0.4	0.0
ERM	FLACS+25 G PPV+ERM/ILM P	0.6	0.1
MH	FLACS+25 G PPV+ILM P+SF 20%	0.5	0.0
MH	FLACS+25 G PPV+ILM P+SF 20%	0.4	0.1

Abbreviations: MH,macular hole; VH, vitreous haemorrhage; ERM, epiretinal membrane; PDR, proliferative diabetic retinopathy; FLACS, femtosecond laser-assisted cataract surgery; PPV, pars plana vitrectomy; ILM, internal limiting membrane; IVTA, intravitreal triamcinolone acetonide injection; PRP, panretinal photocoagulation; SF6, sulphur hexafluoride; P, peeling.

possible risks. FLACS is a novel technique that offers minimal tissue damage and extreme precision during corneal incision creation, continuous circular capsulorhexis (CCC) and nuclear fragmentation. It also allows diminishing the mean average ultrasound power to emulsify the nucleus. Besides these advantages, the relatively high learning curve and expensive equipment could be considered as its disadvantage.[14]

To our knowledge, this study is the first evaluating combined FLACS and 25G PPV. Although there are several studies in the literature as regards phacovitrectomy procedure, we have only detected a literature which has been published the results of combined FLACS and 23G PPV.[15] Gomes-Resa et al. evaluated outcomes of combined FLACS and 23 G PPV.[15] They reported that 85.7% of patients improved their visual acuity. They also reported that the remaining patients maintained their visual acuity. They detected complication in 2 of 21 patients. One of them was foveal subretinal fluid and cystoid macular oedema during the first month after the surgery and the other one was rhegmatogenous retinal detachment. Therefore, they suggested that the application of femtosecond laser in phacovitrectomy is a safe and effective technique that presents advantages compared to conventional techniques in cases of macular pathology and/or vitreous hemorrhage. In our series, we observed an increase of visual acuity in all cases (100%). No serious complications such as iatrogenic retinal break were encountered. The main reason for this might be the smaller diameter of the vitrectomy probe. A higher incidence of complications such as PCO was detected in only 2 cases (6.6%) 3 months after the procedure.

Using a smaller diameter for PPV has some advantages. The main advantage is the lesser tissue trauma which could be expected in larger devices, which has been reported in one study that the procedure lasted longer and complications like iris trauma or retinal breaks were more encountered when using a 20G vitrectomy.[16] Another important point is the smaller side-port advantages of a 25G device which should be considered as lesser trauma on the sclera. However Kobayashi et al. reported no significant differences between the outcomes of 25G and 23G PPV, but they highlighted that microincision vitrectomy surgery may be consider as an alternative treatment.[17]

In overall, our belief is that FLACS combined with PPV is a reliable and effective method to treat PPV indicated patients with mild or moderate cataract. First, the patient and the medical staff are spared by a second surgical intervention. Second, it allows the surgeon to have total control of the architecture and locations of the corneal incisions and anterior capsulorhexis. The diameter of the capsulorhexis is especially important in patients requiring gas tamponade. It is more convenient to perform capsulorhexis with a relatively smaller diameter to preserve the intraocular lens (IOL) position or prevent IOL subluxation into the anterior chamber. Thus, FLACS allows capsulorhexis to be performed at the desired diameter.[15] One of the most comfortable options with FLACS is the facility to perform a precise capsulorhexis even if an intravitreal hemorrhage is present. No staining is required to make the anterior capsule visible. This is especially important in conventional phacovitrectomy procedures due to the loss of the retinal reflex, which makes it difficult to visualize the anterior capsule.

There is one point to remember. We did not implanted multifocal IOL's during our phacovitrectomy procedures. The problem with these IOL's is the poor visualization of the posterior segment, which has been reported in the literature before.[18]

There are some limitations in our study. The first one is the retrospective design. Prospective and comparative case-control studies will give us more information about proper indications of this procedure. The second important point is the relatively low patient number. Currently, FLACS is an expensive surgery. This makes it difficult to produce case series with large patient numbers in short term.

CONCLUSION

We believe that FLACS combined with 25G PPV is an effective technique for the treatment of a various vitreoretinal disorders. It might be the next routine step in required cases. The advantages of

this procedure are more than its disadvantages. More prospective studies with large patient numbers are necessary to win more information about this procedure.

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During this study, no financial or spiritual support was received neither from any pharmaceutical company that has a direct connection with the research subject, nor from a company that provides or produces medical instruments and materials which may negatively affect the evaluation process of this study.

Conflict of Interest

No conflicts of interest between the authors and / or family members of the scientific and medical committee members or members of the potential conflicts of interest, counseling, expertise, working conditions, share holding and similar situations in any firm.

Authorship Contributions

Idea/Concept: *Gönen Başer, Uğur Ünsal;* ***Design:*** *Gönen Başer, Uğur Ünsal;* ***Control/Supervision:*** *Uğur Ünsal;* ***Data Collection and/or Processing:*** *Uğur Ünsal, Gönen Başer;* ***Analysis and/or Interpretation:*** *Ömer Kartı, Gönen Başer, Uğur Ünsal;* ***Literature Review:*** *Ömer Kartı, Gönen Başer;* ***Writing the Article:*** *Gönen Başer, Uğur Ünsal;* ***Critical Review:*** *Gönen Başer, Uğur Ünsal.*

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