# MATÜR KATARAKTI OLAN HASTALARDA FEMTOSANİYE LAZER FAKOEMÜLSİFİKASYON CERRAHİSİ

# Femtosecond Laser-Assisted Cataract Surgery in Eyes with White Mature Cataract

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## ÖZET

**Amaç:** Matür kataraktı olan hastalarda Femtosaniye Lazer ile yapılan fakoemülsifikasyon cerrahisinin, klasik fakoemülsifikasyon cerrahisi ile kıyaslanması.

**Gereç ve Yöntemler:** Femtosaniye Lazer ile yapılan fakoemülsifikasyon cerrahisi geçiren matür kataraktı olan 34 hastanın 34 gözü (Grup 1), klasik fakoemülsifikasyon cerrahisi geçiren matür kataraktı olan 34 hastanın 34 gözü ile retrospektif olarak kıyaslandı (Grup 2).

**Sonuçlar:** İki grup arasında yaş ve cinsiyet açısından anlamlı bir farklılık yoktu. Operasyon öncesi ve sonrası düzeltilmemiş ve en iyi düzeltilmiş görme keskinlikleri açısından da iki grup arasında anlamlı bir farklılık yoktu (p değerleri sırasıyla, 0.659, 0.634, 0.603 and 0.557).İkinci grupta, radyal yırtık, arka kapsül perforasyonu ve vitre kaybı oranı daha fazla idi ve fako zamanı daha uzun idi, ancak fark anlamlı değildi (p değerleri sırasıyla, 0.06, 0.06, 0.113 ve 0.07).

**Sonuç:** Femtosaniye Lazer ile yapılan fakoemülsifikasyon cerrahisi güvenli ve etkin bir metottur. Klasik fakoemülsifikasyon cerrahisi ile kıyaslandığında, radyal yırtık ve arka kapsül perforasyonu gibi komplikasyonların oranı daha düşük ve fako zamanı daha kısadır, ancak aradaki fark anlamlı değildir.

**Anahtar Kelimeler:** *FLFC; Klasik fakoemülsifikasyon; Matür katarakt; Radyal yırtık*

## ABSTRACT

**Purpose:** To compare the results of femtosecond laser-assisted cataract surgery with conventional cataract surgery in eyes with white mature cataract.

**Material and Methods:** Thirty-four eyes of 34 patients with white mature cataract who had undergone femtosecond laser-assisted cataract surgery (FLACS) (Group 1) were compared retrospectively with 34 eyes of 34 patients with white mature cataract who had undergone conventional cataract surgery (Group 2).

**Results:** In respect to the mean age and sex, there were no significant differences between the two groups. There was no significant difference between the mean preoperative and postoperative uncorrected distance visual acuity (UCVA) and best corrected visual acuity (BCVA) of Group 1 and Group 2 (P values, 0.659, 0.634, 0.603 and 0.557, respectively). The percentages of radial tears, posterior capsule rupture and vitreous loss were higher and phaco time was longer in Group 2 than in Group 1, but the differences were not significant statistically (p values, 0.06, 0.06, 0.113 and 0.07, respectively).

**Conclusion:** FLACS is a safe and effective surgery for white mature cataract. When compared with conventional phacoemulsification surgery, although the percentages of some intraoperative complications such as radial tears and posterior capsule ruptures are lower and phaco time is shorter in FLACS, the differences are not significant statistically.

**Keywords:** *FLACS; Conventional phacoemulsification; White mature cataract; Radial tears.*

## INTRODUCTION

Cataract is responsible for approximately half of blindness in the World.1 The proportion of white mature cataracts is still high in developing countries. Surgery of white mature cataracts with conventional phaemulsification is associated with a high rate of intraoperative and postoperative complications, such as incomplete continuous curvilinear capsulorhexis (CCC), radial tears in anterior capsule extending to equator and posterior capsule, rupture of posterior capsule, vitreous loss, nucleus drop, IOL dislocation, corneal burns, intraocular pressure (IOP) rise, persistent corneal edema and anterior chamber reaction.2,3

CCC is the most critical step for the phacoemulsification surgery. Visualization of anterior capsule depends on red reflex coming from the posterior segment of the eye. This red reflex is compromised in eyes with white mature cataracts, poor visualization may increase the risk of radial tears, thus leading to capsule rupture, vitreous loss, nucleus drop and IOL dislocation. The use of Trypan blue dye may facilitate CCC formation.4

Femtosecond laser-assisted cataract surgery offers many potential advantages over conventional cataract surgery including greater precision and accuracy of the anterior capsulotomy, reduced phacoemulsification time, better wound architecture, lower endothelial cell loss, more stable and predictable positioning of the intraocular lens and femtosecond laser astigmatic keratotomy.5-11

In this study, we compared retrospectively the results of femtosecond laser-assisted cataract surgery with conventional cataract surgery in eyes with white mature cataract.

## MATERIAL AND METHODS

The study protocol was approved by the local ethics commitee. An informed written consent was obtained from the patients before the surgery. The study was carried out according to the tenets of the Declaration of Helsinki.

Thirty-four eyes of 34 patients who had undergone femtosecond laser-assisted cataract surgery between February 2017 and November 2017 comprised Group 1. Thirty-four eyes of 34 patients patients who had undergone conventional cataract surgery between February 2017 and November 2017 comprised Group 2. The mean age of the first group was 68.00±9.39 (SD) (54-89) years. Eighteen of them (52%) were males, and 16 (48%) of them were females. The mean age of the second group was 69.23±8.64 (SD) (56-88) years. Sixteen of them (48%) were males and 18 (52%) of them were females. All of the eyes had white mature cataracts and approximately half of them were intumescent in both groups. Biometric measurements of the eyes were performed with A-Scan USG. After purchase of femtosecond laser system to the hospital, FLACS was applied in white mature cataracts. All of the surgeries were performed by the same surgeon (SC).
In Group 1, corneal incisions, capsulotomy and lens fragmentation was done on femtosecond laser system (LenSx, Alcon Inc, USA). 2.2 mm superotemporal clear corneal incision, 1.2 mm sideport and 5 mm capsulotomy were formed, and nucleus was divided into 4 parts. After femtosecond laser application, standard conventional phacoemulsification (Signature, AMO; USA) steps were applied.

In Group 2, standard conventional phacoemulsification (Signature, AMO; USA) was applied. 2.2 mm superotemporal clear corneal incision, 1.2 mm sideport and 5-5.5 mm capsulotomy were formed manually, to facilitate capsulotomy, Trypan Blue Dye was administered to the anterior chamber in all patients. Before completing CCC, liquefied milky cortex was aspirated with an injector to decrease high intracapsular pressure for the safety of capsulorhexis. After CCC, hydrodissection and hydrodelineation were performed. The nucleus was removed by using the “stop and chop” technique. After that, the cortex was aspirated with coaxial irrigation/aspiration. The capsular bag was filled with a cohesive viscoelastic material. A foldable monofocal posterior chamber IOL was implanted in the capsular bag through an injector system. The viscoelastic material was aspirated completely. The entrances were closed with stromal hydration and finally intracameral moxifloxacin was administered for postoperative endophthalmitis prophylaxis.

After surgery, patients used topical antibiotic (Moxifloxacin 0.5%, Vigamox, Alcon, USA) 4 times a day for a week and topical steroid (Dexamethasone Na Phosphate 0.1%, Dexa-sine, Liba, Turkey) 6 times a day for a week, and it was tapered for subsequent 3 weeks. Full ophthalmological examinations were performed preoperatively and 1st day, 1st week, 1st month, 3rd month and 6th month after the operation.

For statistical analysis, SPSS version 22 programme was used. For comparison of data Chi-square test and t test were used. A $p<0.05$ value was accepted as statistically significant.

## RESULTS

In respect to the mean age and sex, there were no significant differences between the two groups ( p values 0.593 and 0.751, respectively). The mean preoperative uncorrected visual acuity (UCVA) of the first group was 1.80±0.22(SD) (light perception -1.30) logMAR and that of the second group was 1.75±0.25(SD) (light perception-1.30) logMAR, (P=0.659). The mean preoperative best corrected visual acuity (BCVA) of the first group was 1.80±0.22 (light perception-1.30) logMAR and that of the second group was 1.75±0.25 (light perception-1.30) logMAR (p=0.603). The mean preoperative intraocular pressure (IOP) of the first group was 18.11±5.26 (10-28) mmHg and that of the second group was 17.88±5.47(10-27) mmHg (P=0.890). The preoperative characteristics of the patients are summarized in Table 1.

**Table1.** The preoperative characteristics of the patients.

| Parameters | Group 1 (FLACS) n=34 | Group 2 (Conventional Phacoemulsification) n=34 | p values |
|---|---|---|---|
| Age (Years) | 68.60 ± 9.39 (SD) (54 - 89) | 69.23 ± 8.64 (SD) (56 - 88) | 0.593 |
| Sex (Male/Female) | 18 / 16 (52% / 48%) | 16 / 18 (48% / 52%) | 0.751 |
| Preoperative UCVA (logMAR) | 1.80 ± 0.22 (light perception - 1.30) | 1.75 ± 0.25 (light perception - 1.30) | 0.659 |
| Preoperative BCVA (logMAR) | 1.80 ± 0.22 (light perception - 1.30) | 1.75 ± 0.25 (light perception - 1.30) | 0.603 |
| Preoperative IOP (mmHg) | 18.11 ± 5.26 (10-28) | 17.88 ± 5.47 (10 - 27) | 0.890 |
| Phacomorphic Glaucoma | 2 (5%) | 2 (5%) | 1,000 |
| Phacolytic Glaucoma | 2 (5%) | 2 (5%) | 1,000 |

Abbrevations: UCVA; uncorrected visual acutiy, BCVA, best corrected visual acutiy, IOP; intraocular pressure, SD; standard deviation, FLACS; Femtosecond laser-assisted cataract surgery.

The mean postoperative UCVA of the first group was 0.08±0.08 (0.00-0.20) logMAR and that of the second group was 0.11±0.13(0.00-0.40) logMAR (p=0.634). The mean postoperative BCVA of the first group was 0.02±0.04 (0.00-0.10) logMAR, and that of the second group was 0.05±0.09 (0.00-0.30) logMAR, (P=0.557). The mean postoperative IOP of the first group was 15.11±3.07(10-19) mmHg and that of the second group was 14.64±3.23(10-19) mmHg, (P=0.677). The mean phaco time of the first group was 1.62±1.02 (0.70-3.50) minutes and that of the second group was 2.63±1.15(0.90-4.20) minutes, (P=0.07).

Preoperatively, phacomorphic and phacolytic glaucoma was present in 2(5%) patients in both groups. These patients were treated with antiglaucomatous agents preoperatively and their IOPs were normalized without any medications postoperatively (p values, 1.00 and 1.00, respectively). Radial tears during capsulorhexis occurred in 4 (11%) eyes in Group 2 patients, no radial tears occurred in Group 1 patients (p=0.06). Posterior capsular rupture occurred in 4 (11%) eyes and vitreous loss occurred only in 1 (5%) eye in Group 2 patients, neither posterior capsular rupture nor vitreous loss occurred in Group 1 patients (p values, 0.06 and 0.113, respectively). Postoperatively, 12 (35%) patients in Group 2 and 8 (23%) patients in Group 1(p=0.09) had transient corneal edema lasting for one week, which resolved with topical steroid therapy. Four (11%) patients in Group 2 and 2 (5%) patients in Group 1 (p=0.221) had persistent corneal edema, their corneal edema resolved within 6 weeks with intense topical steroid and hyperosmotic agents. Four (11%) patients in Group 2 and 2 (5%) patient in Group 1 (p=0.221) had 3+ cell count in anterior chamber, which resolved in 1 month with intense topical steroid therapy. No corneal burn, no nucleus drop, no conversion to ECCE, no IOL dislocation and no postoperative IOP rise occurred in both groups (p=1.00). The intraoperative and postoperative characteristics of the patients are summarized in Table 2. In 6 (17%) patients in Group 2 and 4 (11%) patients in Group 1, due to age-related macular degeneration, postoperative visual outcomes were not satisfactory.

Although the percentages of radial tears, posterior capsule rupture and vitreous loss were higher and phaco time was longer in Group 2 than in Group 1, but the differences were not significant.

**Table 2.** The intraoperative and postoperative characteristics and complications of the patients.

| Parameters | Group 1 (FLACS) n=34 | Group 2 (Conventional Phacoemulsification) n=34 | p values |
|---|---|---|---|
| Postoperative UCVA (logMAR) | 0.08 ± 0.08 (SD) | 0.11 ± 0.13 (SD) | 0.634 |
| | (0.02 - 0.20) | (0.000 - 0.40) | |
| Postoperative BCVA | 0.02 ± 0.04 | 0.05 ± 0.09 | 0.557 |
| (logMAR) | (0.00 - 0.10) | (0.00 - 0.30) | |
| Postoperative IOP | 15.11 ± 3.07 | 14.64 ± 3.23 | 0.677 |
| (mHg) | (10 - 19) | (10 - 19) | |
| Phacotime | 1.62 ± 1.02 | 2.63 ± 1.15 | 0.07 |
| | (0.70 - 3.50) | (0.90 ± 4.20) | |
| Radial Tears | 0 (0%) | 4 (11%) | 0.06 |
| Posterior Capsule Rupture | 0 (0%) | 4 (11%) | 0.06 |
| Vitreous loss | 0 (0%) | 2 (5%) | 0.113 |
| Transient Corneal Edema | 8 (23%) | 12 (35%) | 0.09 |
| Persistant Corneal Edema | 2 (5%) | 4 (11%) | 0.221 |
| AC Reaction | 2 (5%) | 4 (11%) | 0.221 |
| Corneal Burn | 0 (0%) | 0 (0%) | 1.00 |
| Conversion to ECCE | 0 (0%) | 0 (0%) | 1.00 |
| Nucleus Drop | 0 (0%) | 0 (0%) | 1.00 |
| IOL Dislocation | 0 (0%) | 0 (0%) | 1.00 |
| Postoperative IOP rise | 0 (0%) | 0 (0%) | 1.00 |

Abbrevations: UCVA, uncorrected visual acvity, BCVA; best corrected visual acuity IOP; intraocular pressure, AC; anterior chamber, ECCE; extracapsular cataract extraction, IOL; intraocular lens, SD; standard deviation, FLACS; femtosecond laser-assisted cataract surgery.

## DISCUSSION

White mature cataracts carry some difficulties and are a challenge for the surgeon. The main problem is achieving a CCC. If it's not complete, some intraoperative complications may arise. The absence of red reflex, raised intracapsular pressure and a fragile anterior capsule may cause radial tears and these radial tears in anterior capsulotomy may extend to posterior capsule and cause rupture, vitreous loss and nucleus drop in conventional phacoemulsification cataract surgery.12-15

Trypan blue usage and some techniques like minirhexis may avoid this complication to some extent.16 FLACS has realized increasing popularity. Its advantages include customized corneal incisions, capsulotomy, lens fragmentation patterns, reduction of effective phaco energy and endothelial cell loss, reduction of effective phacoemulsification time, fewer intraoperative complications, better refractive stability and predictability.17-20 However, incomplete capsulotomies, microadhesions, anterior capsular extensions with radial tears may be seen in FLACS.21
In our study, we found that the percentages of radial tears, posterior capsule rupture, vitreous loss were higher and phaco time was longer in conventional phacoemulsification group than in FLACS group, but these were not statistically significant. In addition, although the percentages of postoperative transient and persistant corneal edema were higher in conventional phacoemulsification group than in FLACS group, these differences were not statistically significant. In literature, there are so many studies related to comparison of conventional phacoemulsification and FLACS, however, to our knowledge we encountered only one study on comparison of these two techniques in white cataract.

Titiyal et al.13 reported that femtosecond laser-assisted cataract surgery has the advantage of creating a circular and optimally sized capsulotomy in cases of white cataract. The release of white milky fluid during femtosecond laser delivery is the most important factor affecting the creation of a free-floating capsulotomy.
Ewe et al.22 reported that FLACS can be considered non-inferior to conventional PCS in terms of safety and clinical outcomes. However, FLACS has yet to demonstrate an overall cost-benefit to the patient. Taravella et al.23 reported that the femtosecond laser was useful in the surgical approach to patients with complex cataracts, especially for the creation of the capsulotomy. Chan et al.24 found that, in paired human eyes, the capsulotomies created by a femtosecond laser with a contact lens interface were as strong as conventional capsulorhexis. Manning et al.25 reported that FLACS didn't yield better visual or refractive outcomes than conventional phacoemulsification cataract surgery. Intraoperative complications were similar and low in both groups. Postoperative complications were lower in conventional phacoemulsification surgery.

In conclusion, FLACS is a safe and effective surgery for white mature cataract. When compared with conventional phacoemulsification surgery, although the percentages of some intraoperative complications such as radial tears and posterior capsule ruptures are lower and phaco time is shorter in FLACS, the differences are not significant statistically.
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