

## IS THERE ANY RELATIONSHIP BETWEEN PHACOEMULSIFICATION PARAMETERS AND INCREASED SECOND EYE PAIN COMPLAINT?

### FAKOEMÜLSİFİKASYON PARAMETRELERİ İLE İKİNCİ GÖZDE ARTMIŞ AĞRI ŞİKAYETİ ARASINDA HERHANGİ BİR İLİŞKİ VAR MI?

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#### ABSTRACT

**Objective:** To evaluate the relation between pain complaints after cataract surgery and phacoemulsification parameters.

**Materials and Methods:** This prospective study was based on studies of 94 eyes across 47 patients, who underwent cataract surgery at 15 day intervals. The mean values of nucleus grade, total duration of surgery, U/S total time, U/S total equivalent power in foot position 3, cumulative dissipated energy, phacoemulsification time, average phacoemulsification power and average phacoemulsification power in foot position 3 were recorded. Patients were asked to score their pain on the first day, after the first week and after the first month following surgery on each eye.

**Results:** The mean nucleus grade, cumulative dissipated energy, and U/S total time were found significantly higher in the first eye compared with the second eye ( $p=0.01$ ,  $0.016$ , and  $0.03$ , respectively). There was no statistically significant difference in mean operation time, phacoemulsification time, U/S total equivalent power position 3, average phacoemulsification power and average phacoemulsification power position 3 between the first and second eyes. Although there was no statistically significant difference in pain scores between first and second eyes on the first postoperative day and first month, there was a significant difference at one week ( $p=0.080$ ,  $0.269$  and  $0.004$ , respectively). There was no correlation between phacoemulsification parameters and pain scores after both surgeries.

**Conclusion:** This study showed no correlation between the phacoemulsification parameters and postoperative pain scores after both first and second surgeries. In addition, there was a significant difference between the pain scores of the first and that of the second surgery at the first postoperative week.

**Keywords:** Pain, postoperative, cataract extraction, phacoemulsification

#### ÖZET

**Amaç:** Katarakt ameliyatı sonrası ağrı şikayeti ile fakoemülsifikasyon parametreleri arasındaki ilişkiyi değerlendirmek.

**Gereç ve Yöntem:** Bu prospektif çalışmaya, 15 gün arayla katarakt ameliyatı yapılan 47 hastanın 94 gözü dahil edildi. Ortalama nükleus sertliği, ameliyat süresi, total ultrason (U/S) zamanı, total enerji (U/S total equivalent power in foot position 3), kümülatif yayılan enerji, fakoemülsifikasyon zamanı, ortalama fakoemülsifikasyon enerjisi ve ayak pedalı 3. pozisyonda iken kullanılan ortalama fakoemülsifikasyon enerjisi kaydedildi. Hastalardan ağrıları postoperatif birinci gün, birinci hafta ve birinci ay kontrollerinde skorlamaları istendi.

**Bulgular:** Ortalama nükleus sertliği, kümülatif yayılan enerji, total U/S zamanı ilk gözde ikinci göze göre anlamlı olarak artmış bulundu. (sırasıyla  $p=0.01$ ,  $0.016$ , ve  $0.03$ ). İlk göz ve ikinci göz arasında ortalama ameliyat süresi, fakoemülsifikasyon zamanı, total enerji, ortalama fakoemülsifikasyon enerjisi ve ayak pedalı 3. pozisyonda iken kullanılan ortalama fakoemülsifikasyon enerjisi arasında anlamlı fark yoktu. Postoperatif birinci gün ve birinci ayda ağrı skorunda birinci ve ikinci göz arasında istatistiksel olarak bir fark bulunmamasına rağmen, birinci hafta skorlarında anlamlı farklılık vardı. (sırasıyla  $p=0.080$ ,  $0.269$  ve  $0.004$ ). Her iki ameliyattan sonra da fakoemülsifikasyon parametreleri ile ağrı skorları arasında herhangi bir korelasyon yoktu.

**Sonuç:** Bu çalışma, hem birinci hem de ikinci ameliyatlardan sonra fakoemülsifikasyon parametreleri ile postoperatif ağrı skorları arasında korelasyon olmadığını gösterdi. Ek olarak, postoperatif birinci haftada ilk ameliyatın ağrı skorları ile ikinci ameliyatın ağrı skorları arasında anlamlı fark vardı.

**Anahtar Kelimeler:** Ağrı, postoperatif, katarakt ekstraksiyonu, fakoemülsifikasyon

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## INTRODUCTION

Cataract surgery is one of the most common ophthalmologic surgical procedures in the world. Among the anesthetic methods, topical anesthesia is the preferred method due to its advantages (1-3). Clinical observations show that many patients who had cataract surgery with topical anesthesia felt more pain during the surgery on the second eye compared to their first eye (4-8). Several studies have examined the possible causes of the increased pain during second-eye surgery. Some researchers suggest that decreasing preoperative anxiety lies behind the increased pain in the second eye while other researchers suggested that it is linked to patients' perception (4-6). Recently, Zhu et al. (9) found that MCP-1 cytokine (a pain related inflammatory cytokine), exists in second eyes in increased amounts in aqueous humor compared to the first eye, and concluded that the increased pain might be related to a sympathetic ophthalmic type inflammation. Although the study carried out by Zhu et al. (9) is very interesting and valuable, we suggest that it is necessary to look into the effect of surgical time and other surgical parameters on the pain scores after first and second eye surgery before concluding that pain perceived after the fellow eye is more than the first eye. To our knowledge, there have been no studies into whether there is a relation between postoperative pain and surgical parameters.

In this study, we aimed to evaluate whether there is a relation between the pain complaints after cataract surgery and the parameters of phacoemulsification. We also compared the postoperative pain scores in the first operation with those in the second operation on the first day, after the first week and after the first month.

## MATERIALS AND METHODS

This prospective interventional study was based on studies of 94 eyes across 47 patients, who visited Istanbul Medipol University, between September 2015 and January 2016 and were found to have cataracts in both eyes after ophthalmologic examination. All patients signed their informed consent, and the study was performed in accordance with the Declaration of Helsinki. The protocol was approved by the Research Ethics Committee of the Istanbul Medipol University.

Patients with corneal pathology, retinal pathology, glaucoma, uveitis, a high degree of hypermetropia, a high degree of myopia (axial length below 21 mm and above 26 mm), and systemic diseases were excluded from the study. Patients with intraoperative (eg iris prolapse, posterior capsular rupture, vitreous loss, iris hemorrhage, corneal abrasion, nucleus fragments and cortex drop in vitreous) and postoperative complications (eg serious corneal edema or anterior chamber inflammation) were excluded from the study. Phacoemulsification and intra-

ocular lens implantation with topical anesthesia were performed at 15-day intervals. Patients' visual acuity, intraocular pressure values, biomicroscopic and fundoscopic examination findings were recorded preoperatively, at postoperative first day, first week and the first month.

## Surgical Technique

All operations were carried out by the same right-handed surgeon (M.O.) in the same operating room. Tropicamide 5 mg/mL and cyclopentolate hydrochloride 10 mg/mL drops were administered one hour before surgery, and repeated 30 minutes later after first instillation to dilate the pupil. The conjunctival sac was rinsed with povidone iodine (0.02%) 5 minutes before surgery. The topical anesthesia consisted of 3 applications of proparacaine hydrochloride 0.5% ophthalmic solution. Oral and intravenous sedatives or analgesics were not used in any of the patients. After topical anesthesia, two side port corneal incisions were made, and 0.2 ml non-preserved lidocaine 0.5% anesthesia was injected into the anterior chamber. A 2.8 mm temporal clear corneal incision was created, followed by a viscoelastic (Easy Luron %1.6 Sodium Hyaluronate) injection and 5-5.5 mm continuous curvilinear capsulorhexis.

All phaco procedures were done using the Infiniti phaco machine (Alcon Surgical). The Phacoemulsification procedure was performed using a standard quick chop technique. A foldable intraocular lens (SN60WF or SA60AT; Alcon Laboratories, Inc.) was implanted using a dedicated injector. Following the aspiration of residual viscoelastic with bimanual irrigation/aspiration, the corneal wound was hydrated at the end of surgery and the tightness of the corneal wound was checked. At the end of surgery 0.1 mL of solution containing 500 mg moxifloxacin (Vigamox®, Alcon Laboratories, Inc, Fort Worth, TX, USA) was administered intracamerally.

Postoperatively, 0.5% moxifloxacin six times a day, prednisolone acetate 1% six times a day and nepafenac ophthalmic suspension 0.1% three times a day were used. The steroid drop was gradually tapered over 1 month, the moxifloxacin and nepafenac ophthalmic suspensions were discontinued after one week.

The Lens Opacities Classification System II (LOCS II) was used to classify cataract severity, according to photographic standards (10). A person with visually significant cataracts was defined by having, in either eye: any LOCS II grading of  $\geq 2$ , best-corrected visual acuity of  $< 20/40$ . The criteria for choosing the first eye was best-corrected visual acuity.

The total duration of surgery, ultrasound (U/S) total time during operation, U/S total equivalent power in position 3, cumulative dissipated energy, phacoemulsification

time, average phacoemulsification power and average phacoemulsification power in position 3 were recorded separately for both eye surgeries.

Postoperative pain questionnaires were completed on day 1, and at 1 week and 1 month. The questionnaires were administered to each patient before their ophthalmic examinations. The physician explaining the questionnaire and marking the responses did not change (M.Ö.). All patients were asked to grade the pain experienced during the surgery using a Visual Analogue Scale (VAS) – an 11-point numeric scale of pain. The questioning physician first explained to the patient that 0 represents no pain at all and 10 would be the worst pain imaginable. The patients were told to report any change in their medication during first and second eye surgery and there weren't any patients taking pain medication

### Statistical Analysis

The normality of the distribution of each of the parameters was checked using the Kolmogorov–Smirnov normality test. The total duration of surgery, ultrasound (U/S) total time, U/S total equivalent power in foot position 3, cumulative dissipated energy, phacoemulsification time, average phacoemulsification power and average phacoemulsification power in foot position 3 were compared using the independent t-test whereas the nucleus grade was compared using the paired samples t- test between first and second eyes. The correlations between phacoemulsification parameters and pain scores were evaluated using Pearson's correlation. A p-value less than 0.05 was considered statistically significant.

### RESULTS

The study included 47 subjects, 24 female and 23 male, aged between 43 and 82 years (mean  $66.6 \pm 8.8$ ). The preoperative nucleus grades were  $3.3 \pm 0.6$  and  $2.9 \pm 0.7$  in the first operated eye and in the second eye, respectively ( $p=0.014$ ). A comparison of intraoperative parameters between the first and second eyes is given in Table 1.

There was a statistically significant difference in cumulative dissipated energy and U/S total time between first and second eyes ( $p=0.016$ , and  $p=0.030$ , respectively). There was no statistically significant difference in total duration of surgery, phacoemulsification time, U/S total equivalent power foot position 3, average phacoemulsification power and average phacoemulsification power foot position 3 between the first and second eyes.

Pain scores between the first eye and second eye after cataract surgery is given in Table 2 Although no statistically significant difference was found in pain score between the first eye and second eye at the first day and

first month, there was a significant difference at one week ( $p=0.080$ ,  $0.269$  and  $0.004$ , respectively).

No significant correlations were found between phacoemulsification parameters of the first surgery and the pain scores of the first eye and second eye at postoperative first day, first week and first month (Table 3).

There was also no significant correlation between phacoemulsification parameters of the second surgery and the pain scores of the second eye at postoperative first day, first week and first month (Table 4). The correlation between the pain scores of the first and those of the second eye at postoperative first day, first week and first month was not statistically significant ( $r=0.256$ ,  $p=0.126$ ;  $r=0.754$ ,  $p=0.663$ ;  $r=0.155$ ,  $p=0.361$ , respectively).

### DISCUSSION

Our study evaluates the relation between the pain complaints of patients after first-eye and second-eye cataract surgeries and phacoemulsification parameters. When we evaluated the relation between pain and surgical conditions including U/S total time, U/S total equivalent power in position 3, cumulative dispersive energy, phacoemulsification time, average phacoemulsification power and average phacoemulsification power in position 3 of phacoemulsification as well as duration of operation, we found no significant differences between phacoemulsification parameters and pain scores. In our study, we observed that the majority of patients stated that they felt more pain in second eye during postoperative period. Therefore we also compared the postoperative pain scores in the first operation with those in the second operation on the first day, at the first week and first month. We found that patients' pain complaints in their second eye was significantly higher in the first postoperative week, whereas no significant difference was observed on the first day and at first month.

Ursea et al. (4) reported for the first time that there was a subtle increase in pain during second-eye surgery compared with first-eye surgery. They evaluated the pain scores immediately after the second eye operation and on the first postoperative day. They reported higher pain scores in the second eye on the day of the surgery; however, there was no difference in pain scores between the two eyes on the first postoperative day. They concluded that more pain after second eye surgery was associated with decreased preoperative anxiety (4). Jiang et al. (5) also reported that cataract patients were likely to have more pain during second-eye surgery, which may be related to lower preoperative anxiety.

Hari-Kovacs et al. (6) reported that consecutive phacoemulsification does not differ in perceived pain, but nevertheless, patients may believe the second eye

**Table 1. Comparison of phacoemulsification parameters between first and second eye surgeries**

Parameters	First eye mean±SD range	Second eye mean±SD range	p <sup>α</sup>
Mean operation time (min)	14.9±2.7 10-20	15.7±3.1 10-22	0.265
Nucleus grade (LOCS II)	3.3±0.63 2-4	2.9±0.76 2-4	0.01 <sup>μ</sup>
Cumulative dissipated energy	12.06±9.64 3.5-50.9	7.62±5.28 1.16-25.35	0.016
U/S total time (sec)	48.5±33.4 14-165	37.1±32.2 3-125	0.030
U/S total equivalent power in position 3	11.9±4.75 6.4-22.4	10.7±4.92 3.7-22.6	0.130
Phacoemulsification time (sec)	9.6±14.6 0-69	10.8±19.7 0-76	0.856
Average phacoemulsification power	39.6±13.9 12-79	41.2±14.2 7.5-79.5	0.635
Average phacoemulsification power in position 3	2.7±2.8 0-7.5	1.9±2.2 0-7.5	0.368

SD: Standard deviation, U/S: Ultrasound, LOCS II: Lens Opacities Classification System

<sup>α</sup> Independent t test

<sup>μ</sup> Paired samples t-test

**Table 2. Comparison of pain scores between first eye and second eye after cataract surgery over time**

	First eye	Second eye	p*
First day	2.24±2	3.05±2.4	0.080
First week	0.7±1.2	1.78±1.6	0.004
First month	0.38±0.8	0.65±1	0.269

\*Paired samples t-test

surgery more painful because they practically compare it with the lower remembered pain for the first eye procedure.

However some other researchers have reported no significant differences between pain perceived in first-eye surgery and that in second-eye surgery (10, 11).

Previous studies usually focused on subjective psychological mechanisms to explain why patients experienced pain during second eye cataract extraction. Zhu et al. (9) were the first ones to investigate this observation from a molecular perspective in 2015. In their study, they compared inflammatory cytokines by collecting aqueous humor samples in the preoperative period from patients who were having cataract surgery for the first time, and patients who had already had their first eye operated on and had applied for the second-eye surgery. In

their study, they used the cytokine antibody array technique and found that aqueous humor levels of MCP-1 (a pain-related inflammatory chemokine), were significantly increased in patients undergoing cataract surgery on the second eye compared with those undergoing surgery on the first eye. They thought that, this suggests there may be a sympathetic ophthalmic type uveitis in the contralateral eye after first-eye cataract surgery and that may help explain why second-eye phacoemulsification is often more painful (9).

To our knowledge, there is no previous study which has investigated the relation of surgical parameters with postoperative pain scores. In our study there was no significant relation between the phacoemulsification parameters of the first surgery and the pain scores of the first eye, and also there was no significant relation between the phacoemulsification parameters of the second surgery and the pain scores of the second eye at postoperative first day, first week and first month. However when we analyzed the relation between average phacoemulsification power in foot position 3 of the first surgery and the pain scores of the second eye at postoperative first day and first week, we observed the differences (p=0.09 and 0.064, respectively) which might reach statistical significance in a larger sample. We may speculate that the increase in the amount of the energy used in phacoemulsification surgery, especially in average phacoemulsification power in foot position 3, may be increasing the

**Table 3. Correlation between phacoemulsification parameters of the first surgery versus the pain scores of the first eye and second eye**

Parameters	Pain scores of the first eye			Pain scores of the second eye		
	First day	First week	First month	First day	First week	First month
	r p	r p	r p	r p	r p	r p
Mean operation time (min)	0.78 0.343	0.67 0.478	0.56 0.322	0.33 0.675	0.87 0.124	0.54 0.56
Cumulative dissipated energy (min)	0.42 0.811	0.83 0.456	0.54 0.323	0.52 0.741	0.73 0.356	0.35 0.771
U/S total time (sec)	0.65 0.435	0.56 0.443	0.45 0.675	0.68 0.465	0.16 0.343	0.69 0.415
U/S total equivalent power in position 3	0.75 0.234	0.98 0.577	0.73 0.356	0.98 0.294	0.58 0.277	0.56 0.234

U/S: Ultrasound  
 \*Pearson correlation coefficient

**Table 4. Correlation between phacoemulsification parameters of the second surgery and the pain scores of the second eye**

Parameters	Pain scores of the second eye		
	First day r p	First week r p	First month r p
Mean operation time (min)	0.56 0.393	0.97 0.178	0.96 0.522
Cumulative dissipated energy	0.82 0.311	0.43 0.556	0.94 0.123
U/S total time (sec)	0.85 0.535	0.46 0.643	0.75 0.375
U/S total equivalent power in position 3	0.95 0.334	0.18 0.877	0.79 0.346
Phacoemulsification time (sec)	0.55 0.778	0.43 0.226	0.96 0.343
Average phacoemulsification power	0.23 0.697	0.54 0.821	0.18 0.677
Average phacoemulsification power in position 3	0.66 0.321	0.33 0.716	0.78 0.277

U/S = Ultrasound  
 \*Pearson correlation

amount of inflammatory chemokines. This situation may be giving rise to a kind of sympathetic ophthalmic type uveitis.

## CONCLUSION

Pain scores after uneventful cataract surgery differ between first and second eye procedures. A possible relation might be between the phacoemulsification parameters of the first surgery, especially average phacoemulsification power in foot position 3, and the second eye pain scores. More studies with larger sample sizes may strengthen the value of our study.

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