

# Changes in Lower Lid Position after Standard Phacoemulsification Cataract Surgery

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## Abstract

**Purpose:** To evaluate the changes on the position of the lower lid after phacoemulsification surgery using objective methods.

**Methods:** This prospective study evaluated the lower lid position of cataract carriers who underwent to phacoemulsification surgery from January to May 2017. Data were collected on demographics, type of anesthesia, duration of the surgical procedure, and duration of the speculum remained in place. Standardized digital photographs of the patient's face in primary gaze position were obtained preoperatively and 1, 30, 90, and 180 days, postoperatively. The data were analyzed on the distraction test, distance of the lower lacrimal punctum from the inner canthus, and margin reflex distance 2 (MRD2). Comparative and correlation statistical analyses involving preoperative and postoperative measurements were performed.

**Results:** One hundred twelve cataract patients comprised the study sample. There were 68 (60.7%) females with a median age of 74 (interquartile range, 70–81) years old. The mean distraction test value before surgery was  $7 \pm 2$  mm and  $6.8 \pm 1.8$  mm 180 days postoperatively ( $P = 0.02$ ). The mean lacrimal lower punctum distance changed from  $5 \pm 1.1$  mm preoperatively to  $5.4 \pm 1$  mm at 180 days postoperatively ( $P = 0.06$ ). The mean MRD2 preoperatively was  $5 \pm 1$  mm and increased to  $5.4 \pm 0.9$  mm 180 days after surgery ( $P = 0.02$ ). The duration of surgery and the duration that speculum remained in place were not correlated to MRD2 ( $P = 0.7$ ;  $P = 0.98$ ).

**Conclusions:** There is a mild lower lid laxity after phacoemulsification reflected by slight increased lacrimal lower punctum distance to the inner canthus and MRD2. Lacrimal lower punctum distance and MRD2 vary along the study and remained altered at 180 days after surgery, while distraction test tends to recover to similar preoperative levels. Although lid laxity is common in elderly cataract carriers, even a short procedure as phacoemulsification can mildly increase flaccidity.

**Keywords:** Distraction test, Lacrimal lower punctum, Lid laxity, Lower lid position, Margin reflex distance, Phacoemulsification

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**Submitted:** 27-Feb-2020; **Revised:** 11-Apr-2020; **Accepted:** 27-Apr-2020; **Published:** 04-Jul-2020

## INTRODUCTION

Surgery for senile cataract involves significant manipulation of the lids with possibility to alter lid position. Ptosis following cataract surgery has been well documented.<sup>1,2</sup> However, changes in the position of the lower lid after cataract surgery have not been extensively evaluated. Previous literature has reported ectropion or entropion<sup>3</sup> and punctum ectropion in 4% of the patients following extracapsular cataract surgery.<sup>3</sup>

Alterations to the lid position as ptosis or lower lid entropion after cataract surgery seems to be related to multiple etiological processes.<sup>3-5</sup> During cataract procedure, the lids are subjected to several maneuvers including fluid injections, traction sutures, and use of lid speculum which further increases involuntional changes or laxity of the canthal ligaments.<sup>4</sup>

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**How to cite this article:** García Zamora M, Marqués Fernández VE, Calabuig Goena M, Díez Montero C, Schellini SA, Khandekar R, *et al.* Changes in lower lid position after standard phacoemulsification cataract surgery. *J Curr Ophthalmol* 2020;32:281-4.

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DOI:  
10.4103/JOCO.JOCO\_73\_20

To the best of our knowledge, changes in lower lid position after phacoemulsification cataract surgery have not been documented. This study used objective and reproducible quantitative methods to evaluate modifications in the lower lid position after phacoemulsification cataract surgery and to determine the factors influencing these changes over the course of postoperative follow-up.

## METHODS

This is a one-arm prospective study to evaluate the position of the lower lid in cataract carriers before and after phacoemulsification surgery from January to May 2017. This study adhered to the tenets of the Declaration of Helsinki, and the Institutional Research Board Committee at the Rio Hortega University Hospital, Valladolid, Spain, approved the study protocol. All patients signed written informed consent. In the form the patients have given their consent for publishing their photos.

All the consecutive patients were considered for inclusion. Patients with previous lid surgery, inflammatory ocular conditions, and systemic diseases such as Myasthenia gravis, Horner's syndrome, and thyroid disease and patients who experienced intraoperative complications were excluded.

All the phacoemulsification procedures were standard, and three ophthalmic surgeons performed the surgeries under topical or peribulbar anesthesia. The 15-mm reusable Barraquer wire lid speculum, open blades were used in all patients. Bridle sutures were not used in any patient. A clear corneal incision near the superior limbus was the port of entry into the anterior chamber. The EyeCee® One (Bausch and Lomb Inc., Rochester, NY, USA) preloaded intraocular lens was placed in the capsular bag in all cases.

Duration of the surgical procedure was defined as the time in minutes and seconds from the paracentesis to the closure of the corneal wound. Duration of the wire lid speculum remaining in place was defined as the time in minutes and seconds from the insertion of the speculum to its removal.

A pretested data sheet form was used to collect data on patient demographics including ethnicity, gender, age, side of surgery, personal history of systemic disease and medications, duration of surgical procedure, duration of the speculum remaining in place, and lower lid position. For the lower lid position evaluation, all the patients were examined preoperatively and 1, 30, 90, and 180 days after phacoemulsification surgery according to the following parameters:

1. Distraction test measured with a ruler, in primary gaze position, and defined as the distance in mm between the globe and the lower lid margin when it is pulled away. A normal distraction test was defined as  $6.96 \pm 1.12$  mm<sup>6</sup>
2. Objective measurements of lower lid position were done based on obtained standard photographs of the upper third of the face including both eyes before instillation of any topical medication, under bright illumination, at a

fixed distance of 40 cm, with patient seated and looking straight ahead at a fixed point, in primary gaze position and without any facial expression, using a Nikon D90 digital camera (Nikon D90; Nikon Corp., Tokyo, Japan) [Figure 1]. All the measurements were performed by the same operating surgeon, using the standard photos with the ImageJ (FIJI 1.46r, revised edition) image processing software (National Institutes of Health) and an objective imaging system;<sup>7</sup> therefore, the graders were not masked to the patients. The evaluated parameters were:

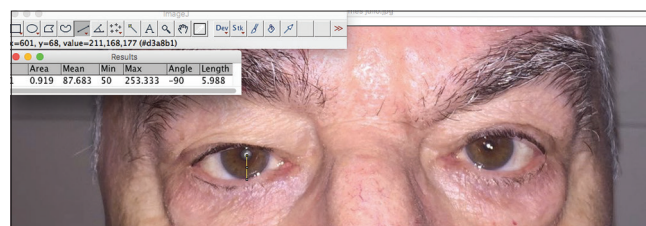
- a. Distance of the lower lacrimal punctum from the inner canthus defined as the distance from the inner canthus to the center of the lacrimal inferior punctum in mm
- b. Margin reflex distance 2 (MRD2) defined as the distance from the lower lid margin to the corneal light reflex in primary gaze position. Normal measurements of MRD2 were considered as  $5.1$  to  $6.3 \pm 0.3$  mm.<sup>8</sup> Indirectly, lower lid retraction evaluation was defined as an abnormal downward displacement of the lower lid, with increased MRD2.<sup>9</sup>

## Statistical analysis

All data were transferred to an access spreadsheet (Microsoft Corp., Redmond, WA, USA), and univariate analysis was performed using Statistical Package for the Social Sciences (SPSS 24, IBM Corp., Armonk, NY, USA). For qualitative variables, we calculated frequencies and percentage proportions. If the quantitative variables were distributed normally, the mean and standard deviation of the outcome variables were calculated, and if distribution was not normal, non-parametric analysis for statistical validation was used, resulting in median and interquartile range (IQR) values. For multiple continue variables that were not normally distributed, Friedman *P* value was calculated for validation. Correlation analysis was applied to study the relation of MRD2 with other variables as type of anesthesia (topical or peribulbar injection), duration of surgery procedure, and duration that the speculum remained inserted. For correlating two continuous variables that were not distributed normally, Wilcoxon *P* value was calculated. *P* < 0.05 was considered statistically significant.

## RESULTS

The study sample comprised 112 cataract patients, all of whom were of white Caucasian ethnicity, 68 (60.7%) were females



**Figure 1:** ImageJ (FIJI 1.46r, revised edition) image processing software used to evaluate measurements of margin reflex distance 2 and position of the lower punctum in a patient 1 month after phacoemulsification surgery

with a median age of 74 (IQR: 70–81), mean  $74.7 \pm 7.2$  years, and 67 (59.8%) had surgery in their left eye. Topical and intracameral anesthesia was used in 104 (92.9%) patients, and 8 (7.1%) received peribulbar anesthesia.

The median duration of surgery was 15 (IQR: 13–18), mean  $16.7 \pm 6.7$  min. The median duration that the speculum remained inserted was 17 (IQR: 15–20), mean  $18.9 \pm 7$  min. There were no intraoperative complications. Postoperative complications occurred in 2 patients, both presenting cystoid macular edema.

The distraction test before surgery was  $7.0 \pm 2.0$  mm, with mild increase after 30 days ( $7.4 \pm 1.9$  mm), sustained after 90 days ( $7.4 \pm 2.4$  mm), and decreasing after 180 days ( $6.8 \pm 1.8$  mm) to a level similar to the initial values ( $P = 0.02$ ) [Table 1]. The lower lid punctum distance from the inner canthus preoperatively was  $5.0 \pm 1.1$  mm and  $5.4 \pm 1.0$  mm at 180 days postoperatively ( $P = 0.06$ ) [Table 1].

The MRD2 preoperatively was  $5.0 \pm 1.0$  mm,  $5.4 \pm 1.0$  mm at 30 days postoperatively,  $5.2 \pm 1.0$  mm at 90 days, and  $5.4 \pm 0.9$  mm at 180 days after surgery ( $P = 0.02$ ). The median change between preoperative MRD2 (5.0 mm, 25% quartile = 4.35) and 180 days after surgery measurements was +0.4 mm (25% quartile +0.5) [Table 1].

MRD2 was not correlated to gender ( $P = 0.2$ ) or age ( $P = 0.3$ ). The duration of surgery ( $P = 0.7$ ) and time that the speculum remained in place ( $P = 0.9$ ) were not correlated to MRD2.

## DISCUSSION

Our results indicate mild changes in the lower lid position after phacoemulsification cataract surgery. Comparing preoperative

evaluation with 6 months after phacoemulsification surgery, we observed distraction test not altered, minimum lateral displacement of lower lacrimal punctum, and a discrete increase in MRD2. These changes were considered clinically mild, and the magnitude was not large enough to be considered lower lid retraction.

Our patients were over 70 years old. In general, laxity or even malposition of the lower lids as ectropion or entropion can be observed in older individuals.<sup>4</sup> Although none of our patients had clinical lid malposition prior to phacoemulsification surgery, involutional changes such as ligaments laxity may be present, being difficult to separate age-specific changes from surgery caused. Hence, the lower lid changes observed in our patients cannot be attributed specifically to phacoemulsification surgery, although we can suggest that it could play a role.

Periocular injection has been associated with lower lid malposition after surgery.<sup>3</sup> However, our outcomes indicate no significant association in lower lid malposition and peribulbar anesthesia. Nevertheless, it should be interpreted with caution because only 7.14% of our patients received peribulbar anesthesia.

The values for the distraction test in our study had a mild increase from day 1 to 90 after surgery. However, at 180 postoperative days, it recovered to similar preoperative levels. This discrete (0.4 mm) transient alteration at 30 days can be interpreted as likely induced by the speculum over lids already with laxity. At 6 months postoperatively, the increased horizontal laxity in the lower lid can partially resolve if another lid alteration is absent.

We observed that the distance from the inner canthus to the lower lacrimal punctum had a mild increase

**Table 1: Distraction test, lower lid punctum distance, and margin reflex distance 2 before and at different follow-up visits after phacoemulsification surgery**

Variable	Before surgery	Postoperatively				P
		Day 1	30 days	90 days	180 days	
Distraction test*						
Number	103	105	94	73	84	0.02
Mean	7.0	6.6	7.4	7.4	6.8	
SDV	2.0	1.8	1.9	2.4	1.8	
Lacrimal punctum distance*						
Number	103	105	95	75	86	0.06
Mean	5.0	5.2	5.3	5.2	5.4	
SDV	1.1	0.9	0.9	0.9	1.0	
MRD2**						
Number	110	106	103	79	110	0.02
Mean	5.0	5.1	5.4	5.2	5.4	
SDV	1.0	1.1	1.0	1.0	0.9	
Median	5.0	5.1	5.3	5.2	5.4	
25% quartile	4.3	4.3	4.6	4.5	4.9	
Minimum	2.7	3.1	3.3	3.1	2.2	
Maximum	7.3	7.9	8.3	8.5	8.5	

$P < 0.05$  is statistically significant. \*Parametric test, \*\*Non-parametric test. MRD2: Margin reflex distance 2, SDV: Standard deviation of the outcome variables

postoperatively ( $5 \pm 1.1$  mm preoperative to  $5.4 \pm 1.0$  mm at 180 days). The amount was not statistically significant, but this slight displacement of the lower punctum over time may indicate the possibility of mild inferior lid laxity. According to others, punctum ectropion is often associated with involuntional changes, but punctum ectropion development may be speeded up by cataract operation or may be coincidental, since both cataract development and punctum ectropion commonly occur in the older age group.<sup>3</sup> Despite the mild increase in MRD2 observed ( $+0.4$  mm; 25% quartile  $+0.5$ ), the change values were very small, and the final MRD2 might be considered within normal values<sup>8</sup> and can be considered not clinically significant.

Postoperative changes of distance from the inner canthus to the lower lacrimal punctum and MRD2 can be explained by the manipulation during the surgical procedure combined with a weaker anatomy of the lid due to age-related changes. According to others, lower lid alterations after cataract surgery on the same basis as upper lid ptosis may be developed due to disinsertion of the capsulopalpebral fascia which is analogous to the levator aponeurosis in the upper lid.<sup>4</sup> Minimal alterations of the lower lid position can be accentuated secondary to manipulation of the lids during surgery,<sup>3,4</sup> increasing laxity of the canthal ligaments.

Some researchers have proposed that the duration of the surgery could be related to major trauma by the lid speculum when the insertion between muscles aponeurosis and the tarsus are weak,<sup>3</sup> precipitating ptosis or lower lid retraction. Our procedures were all very fast as usual in phacoemulsification surgery, resulting in no correlation between the duration of surgery neither duration that the speculum was inserted and changes in MRD2. However, even in a very fast procedure, the speculum could induce minimal trauma.

Our study strength is that we used standard digital images and specialized software to perform objective measurements. We believe that the methods used in our study can be considered reliable, easy to reproduce, and an optimum method to quantify and objectively compare the lower lid position than manual measurement used in previous studies.<sup>5,10-13</sup> Objective evaluation offers reliable measurements and follow-up of the very mild lower lid changes.

There are some limitations of this study including the small sample size and the lack of randomization. Ideally, a randomized controlled clinical trial with a large sample size and a similar control group would contribute for a more statistically powerful study. Furthermore, a few patients did not show in

some visits since they were elderly. Imaging or histological studies would also be helpful to confirm our hypothesis and to better understand the pathogenesis of these changes in lid position.

In conclusion, after phacoemulsification surgery, it is possible to observe a mild increase in lower lid punctum distance from the inner canthus and MRD2, suggesting lower lid laxity. Although lid laxity is common in elderly cataract carriers, even a short procedure as phacoemulsification can permanently increase lid flaccidity.

### **Financial support and sponsorship**

Nil.

### **Conflicts of interest**

There are no conflicts of interest.

## **REFERENCES**

1. Mehat MS, Sood V, Madge S. Blepharoptosis following anterior segment surgery: A new theory for an old problem. *Orbit* 2012;31:274-8.
2. Paris GL, Quickert MH. Disinsertion of the aponeurosis of the levator palpebrae superioris muscle after cataract extraction. *Am J Ophthalmol* 1976;81:337-40.
3. Hosal BM, Tekeli O, Gürsel E. Eyelid malpositions after cataract surgery. *Eur J Ophthalmol* 1998;8:12-5.
4. Hurwitz JJ, Smith D, Corin SM. Association of entropion with cataract surgery. *Ophthalmic Plast Reconstr Surg* 1990;6:25-7.
5. Feibel RM, Custer PL, Gordon MO. Postcataract ptosis. A randomized, double-masked comparison of peribulbar and retrobulbar anesthesia. *Ophthalmology* 1993;100:660-5.
6. Milbratz-Moré GH, Pauli MP, Lohn CL, Pereira FJ, Grumann AJ. Lower eyelid distraction test: New insights on the reference value. *Ophthalmic Plast Reconstr Surg* 2019;35:574-7.
7. Ribeiro SF, Shekhovtsova M, Duarte AF, Velasco Cruz AA. Graves Lower eyelid retraction. *Ophthalmic Plast Reconstr Surg* 2016;32:161-9.
8. Van Den Bosch WA, Leenders I, Mulder P. Topographic anatomy of the eyelids, and the effects of sex and age. *Br J Ophthalmol* 1999;83:347-52.
9. Ribeiro SF, Milbratz GH, Garcia DM, Devoto M, Guilherme Neto H, Mörschbacher R, *et al.* Pre-and postoperative quantitative analysis of contour abnormalities in graves upper eyelid retraction. *Ophthalmic Plast Reconstr Surg* 2012;28:429-33.
10. Tamaki R, Goshō M, Mizumoto K, Kato N, Zako M. Influence of upper and temporal transconjunctival sclerocorneal incision on marginal reflex distance after cataract surgery. *BMC Ophthalmol* 2016;16:95.
11. Altieri M, Truscott E, Kingston AE, Bertagno R, Altieri G. Ptosis secondary to anterior segment surgery and its repair in a two-year follow-up study. *Ophthalmologica* 2005;219:129-35.
12. Koh V, Tatsios J, Chew PT, Amrith S. Comparison of incidence of ptosis after combined phacotrabeculectomy with mitomycin C and phacoemulsification. *Indian J Ophthalmol* 2015;63:895-8.
13. Loeffler M, Solomon LD, Renaud M. Postcataract extraction ptosis: Effect of the bridle suture. *J Cataract Refract Surg* 1990;16:501-4.