ORIGINAL RESEARCH ORİJİNAL ARAŞTIRMA

DOI: 10.5336/ophthal.2025-108251

Long Term Optic Biometry Changes After Upper Eyelid Blepharoplasty and Ptosis Surgeries: A Cross Sectional Research

Üst Göz Kapağı Cerrahilerinden Sonra Uzun Dönemdeki Optik Biyometri Değişimleri: Kesitsel Araştırma

Nazan ACAR ESER[a], Kübra SERBEST CEYLANOĞLU[b], Emine MALKOÇ ŞEN[c]

[a]University of Health Science Faculty of Medicine, Ulucanlar Eye Training and Research Hospital, Department of Ophthalmology, Ankara, Türkiye
[b]Ankara Bilkent City Hospital, Clinic of Ophthalmology, Ankara, Türkiye
[c]Ankara Etlik City Hospital, Clinic of Ophthalmology, Ankara, Türkiye

ABSTRACT Objective: Gaining a better understanding of the effect of upper eyelid (UE) position on optical biometry and related parameters by evaluating patients before and after blepharoplasty and anterior levator resection (ALR), particularly 6 months post-operatively, as this period can be considered the optimal time frame for cataract surgeries. **Material and Methods:** Seventy patients with dermatochalasis and 40 patients with UE ptosis were included and 110 eyes were evaluated. Measurements were taken before and 6 months after the surgeries using a Lenstar optical biometer. Intraocular pressure (IOP), flattest keratometry, steepest keratometry (K2), mean keratometry (Km), axial length, pupil diameter, anterior chamber depth, lens thickness, corneal astigmatism (CA), and intra ocular lens (IOL) power calculations by using SRK/T, SRK II, Haigis, Holladay 2, Hoffer Q, Barret II formulas were evaluated. **Results:** In both groups, postoperative measurements indicated an increase in IOP (p=0.001 for both). K2, Km, and CA values decreased in the ptosis group and IOL power calculations showed a significant increase (p<0.001, p<0.005 for all, respectively). In the dermatochalasis group, postoperative CA and K2 values demonstrated a significant decrease (p=0.001, p=0.011, respectively), however, no changes were noted in IOL power calculations. **Conclusion:** In summary, the study's results showed that while both blepharoplasty and ALR surgeries can impact the cornea's biometric properties, significant changes were specifically observed in ptosis patients post-operatively concerning IOL power measurements. This could imply that the degree of the UE drop can have a more significant or measurable impact on optical biometry.

Keywords: Dermatochalasis; intraocular lens power; keratometry; optical biometry; upper eyelid ptosis

ÖZET Amaç: Bu çalışmanın amacı, blefaroplasti ve levator cerrahisi (LC) öncesi ve sonrası, özellikle katarakt ameliyatları için en ideal zaman dilimi olarak kabul edilen ameliyat sonrası altıncı ayda hastaları değerlendirerek, üst göz kapağı (ÜGK) pozisyonunun optik biyometri ve ilgili parametreler üzerindeki etkisinin daha iyi anlaşılmasını sağlamaktır. **Gereç ve Yöntemler:** ÜGK dermatoşalazisli 70 hasta ve pitozu olan 40 hasta çalışmaya dâhil edildi ve 110 göz değerlendirildi. Ölçümler ameliyatlardan önce ve 6 ay sonra optik biyometri kullanılarak yapıldı. Göz içi basıncı (GİB), en düz keratometri, dik keratometri (K2), ortalama keratometri [mean keratometry (Km)], aksiyel uzunluk, pupil çapı, ön kamara derinliği, lens kalınlığı, korneal astigmatizm (KA) ve SRK/T, SRK II, Haigis, Holladay 2, Hoffer Q, Barret II formülleri kullanılarak göz içi lens (GİL) gücü hesaplamaları değerlendirildi. **Bulgular:** Her iki grupta da postoperatif ölçümlerde GİB'de artış görüldü (Her ikisi için de p=0,001). K2, Km ve KA değerleri ptozis grubunda azaldı ve GİL gücü hesaplamalarında anlamlı artış görüldü (Her ikisi için sırasıyla p<0,001, p<0,005). Dermatoşalazis grubunda postoperatif KA ve K2 değerleri anlamlı azalma gösterdi (sırasıyla p=0,001, p=0,011), ancak GİL gücü hesaplamalarında herhangi bir değişiklik görülmedi. **Sonuç:** Sonuçlar hem blefaroplasti hem de LC sonrası korneanın ve GİL özelliklerini etkileyebileceğini, ancak özellikle ptozis hastalarında ameliyat sonrası GİL ölçümleri ile ilgili olarak önemli değişiklikler gözlemlendiğini göstermiştir. Bu, ÜGK'nin düşüklük derecesinin optik biyometri üzerinde daha önemli veya saptanabilir bir etkiye sahip olabileceğini göstermektedir.

Anahtar Kelimeler: Dermatoşalazis; göz içi lens gücü; keratometri; optik biyometri; üst göz kapağı pitozu

Correspondence: Nazan ACAR ESER
University of Health Science Faculty of Medicine, Ulucanlar Eye Training and Research Hospital, Department of Ophthalmology, Ankara, Türkiye
E-mail: drnazanacar@gmail.com

Peer review under responsibility of Turkiye Klinikleri Journal of Ophthalmology.

Received: 06 Jan 2025 ***Received in revised form:*** 10 Mar 2025 ***Accepted:*** 10 Mar 2025 ***Available online:*** 03 Jul 2025

Upper eyelid (UE) ptosis and dermatochalasis are conditions that can significantly impair visual function.[1] The reduction in light influx due to palpebral narrowing has been shown to affect contrast sensitivity and cause altitudinal visual field defects, particularly affecting the upward gaze in patients with UE dermatochalasis.[2,3] Blepharoplasty and UE ptosis correction surgeries can modify the height, shape, and extent of eyelid-cornea contact, and both procedures have the potential to alter corneal curvature, and additionally, both surgeries can change ocular properties and visual functions by adjusting retinal illumination and ocular optical functions.[4,5]

In the current study, the authors aimed to acknowledge the effect of UE position on optical biometry and intraocular pressure over a longer period, particularly 6 months after the surgeries, as most cataract surgeries are typically performed at least 6 months after the previous eyelid surgeries. Since cataract surgeries and these UE procedures are primarily performed on similar age groups, and nowadays, intraocular lens (IOL) calculations are desired with more certain results, the effect of these changes on optical biometry gains much more importance.[6] Furthermore, achieving clearer and error-free refractive outcomes has become the primary goal following cataract surgeries since precise IOL power calculation is crucial to meet patient expectations for superior visual quality today. Any alteration in corneal surface or anterior chamber parameters can significantly impact these calculations.[7] In clinical practice 4th generation IOL calculation formulas are usually preferred that are grounded in a theoretical eye model and preserve the positive relationship between axial length (AL) and keratometry with anterior chamber depth (ACD).[7] It has been previously observed that these parameters could change after the surgeries that alter the UE position.[8,9] Based on these observations, assessing this patient group with both 4th-generation formulas like the Barrett Universal II, the Haigis, the Holladay II, and the other commonly used 3rd- and 2nd-generation formulas in daily ophthalmological practice is expected to yield more valuable and comprehensive results. Thus, in the pursuit of optimal refractive results and enhanced patient satisfaction, it is imperative to consider the potential implications of UE surgeries on these IOL calculation formulas.[4,9-11]

Prevention of refractive deviation following cataract surgery has gained increasing importance in recent years, particularly with the implantation of toric or multifocal IOLs. Consequently, adjusting and correcting the position of UE prior to refractive surgeries is now crucial to ensure more accurate IOL power measurements. The current study examined the importance of UE position in patients with severe ptosis and mild UE blepharoptosis in the context of frequently used IOL calculation formulas in clinic practice from different generations, highlighting its potential impact on the accuracy of IOL power determination 6 months after the surgeries. The authors believe that the present study would be highly beneficial on this area.

MATERIAL AND METHODS

PATİENTS

This prospective study was adhered to the tenets of the Declaration of Helsinki. Local Clinical Research Ethics Committee approval was obtained for the study from Ankara Bilkent City Hospital (date: November 22, 2022; no: E1/22/2022). After the study protocol was fully explained the patients, all of the participants provided with written informed consent to participate. From November 2022 to January 2024, 110 eyes of 110 patients who had undergone surgeries for acquired ptosis and dermatochalasis (n=40, n=70 respectively) were included in the study. Patients who participated underwent selection based on established clinical parameters. Those with UE ptosis exhibited a minimum eyelid drop of 3 mm, had UE margin reflex distance (MRD1) measurements of 1 mm or less, and maintained a levator function of at least 6 mm. Additionally, patients with recurrent ptosis and ones that have to undergo ptosis correction surgery more than once were not included. Conversely, participants diagnosed with dermatochalasis with MRD1 measurements of at least 4 mm, alongside preserved normal levator muscle function included in the study.

Inclusion criteria required patients to have intraocular pressure [intraocular pressure (IOP)<21 mmHg], Grade 3 or 4 anterior chamber angles (assessed by the Van Herrick method), and a manifest refraction spherical equivalent within ±3 diopters. Participants also had a normal anterior segment, except for mild nuclear sclerotic cataracts. Exclusion criteria included known glaucoma or ocular hypertension, a detected shallow anterior chamber, pre-existing eye disorders such as uveitis, corneal dystrophies, or scarring, as well as current use of topical or systemic steroids. Participants with any illness that may impact the eye or eyelid position like Graves' orbitopathy, neurodegenerative disorders, generalized muscular diseases, or prolonged soft or hard contact lens users were also excluded. Patients with retinal diseases or a history of cataract or refractive surgery were excluded.[12]

Evaluations were made before the surgeries and on the control visit 6 months post-operatively. All patients had comprehensive ocular evaluations before surgery, including best-corrected visual acuity, slit lamp biomicroscopy, IOP measurements by Goldman applanation tonometry and detailed, dilated fundoscopy. To prevent intervention of diurnal fluctuations, IOP measurements were made between 9.00-10.00 am.[13] The right eyes of the dermatochalasis patients were chosen and assessed.

The evaluated ocular biometric parameters were the flattest keratometry (K1), steepest keratometry (K2), mean keratometry (Km), corneal astigmatism (CA), anterior chamber depth (ACD), AL, and IOL power (using an A constant of 118.7 with Acrysof IQ from Alcon Laboratories, Inc.) (the mean recommended IOL powers targeting emmetropia) were measured using optical biometry (LenStar LS 900; Haag Streit Diagnostics, Köniz, Switzerland). These same ophthalmological measurements were conducted both before and 6 months after the surgeries. Participants with AL values between 22-25 mm included in the study.

SURGİCAL TECHNİQUES

All surgical procedures were performed using the same techniques for each procedure. In cases of UE ptosis, anterior levator resection (ALR) was performed. The surgical steps were as follows: First, the UE crease was marked to ensure symmetry with the other eyelid crease using a surgical pen. A local anesthetic of 2% lidocaine with 1 mL epinephrine was injected along the incision line. After waiting 5 minutes for bleeding control a skin incision was made at the UE markings, and the orbicularis muscle was detached from the tarsal plate using Westcott scissors and intraoperative hemorrhage was controlled by using a bipolar cautery when needed. The tissues remaining on the surface of the tarsal plate were removed to expose at least 1/3 of the tarsal plate. After dissection of orbicularis muscle and septum, preaponeurotic fat pad was reached and a Desmarres retractor was used to separate it from the underlying levator aponeurosis. The levator aponeurosis was then carefully dissected from the Müller's muscle up to Whitnall's ligament using sharp dissection. A fixation sling suture was inserted from the tarsal plate with a knot using a double-armed 6-0 vicryl suture, placed proximally to Whitnall's ligament. Once the desired eyelid level was achieved, 2 additional sling sutures were placed medially and laterally to the first suture at equal distances. Three cardinal sutures were placed from skin to orbicularis and back to the skin to emphasize the new crease, using 6-0 vicryl. The skin on both sides was closed using interrupted 6-0 vicryl sutures. Postoperatively, all patients were treated with oxytetracycline 1% ointment (Terramycin®, Pfizer, Türkiye) applied twice daily for 1 week. Sutures were removed 7 days after the surgery.

As for the patients with dermatochalasis, every step was executed bilaterally and sequentially on individuals undergoing bilateral UE blepharoplasty. With the patient seated, the UE crease was marked before administering local anesthesia. The inferior marking was positioned at the supratarsal crease and extended to the lateral canthus from a point above the lacrimal punctum. A pinch test was used to quantify the surplus skin while preserving at least 1 cm of infrabrow skin. Following incision marking, a subcutaneous injection of 3-5 ml of a 2% lidocaine and 1:100,000 epinephrine combination was administered into each eyelid. The skin and subcutaneous tissue in the designated region were then removed surgically. The skin closure was performed as described for ALR surgery. Sutures were removed 7 days after surgery.

STATİSTİCAL ANALYSİS

Statistical analyses were performed with SPSS (IBM Corporation, Armonk, NY) version 22.0. The data were presented as the mean±standard deviation. The chi-square test was used for analyzing categorical variables. The normality of the data was assessed using the Kolmogorov-Smirnov test. Student t-test was utilized for variables that exhibited a normal distribution. Mann-Whitney U test was employed for variables that did not demonstrate normal distribution. A p value <0.05 was considered as statistically significant.

RESULTS

The demographic characteristics among the groups were similar. The study included 50 men (mean age 58.36±12.41 years) and 60 women (mean age 56.48±11.22 years), with no statistically significant difference observed between the genders (p=0.012). In the dermatochalasis group, there were 70 patients (32 men, mean age 57.00±19.52 years; 38 women, mean age 53.16±14.03 years), while the ptosis group comprised 40 unilateral cases (18 men, mean age 60.39±13.66 years; 22 women, mean age 56.77±14.72 years). Table 1 shows comparisons of demographic findings of the participants.

Table 2 illustrates the measurements of dermatochalasis patients both before and after blepharoplasty surgeries. Post-operatively CA and K2 values exhibited a significant reduction (p<0.001 and p=0.011, respectively), while the increase in IOP measurements was statistically significant (p<0.001). Furthermore, no significant difference was noted in IOL power, as calculated by using 6 different IOL calculation formulas.

TABLE 1: Demographic data of the dermatochalasis and ptosis patients

	Dermatochalasis (n=70)	Ptosis (n=40)	p value
Gender (Male/female)	32/38	18/22	0.012¶
Female age (X̄±SD, years)	53.16±14.03	56.77±14.72	0.013*
Male age (X̄±SD, years)	57.00±19.52	60.39±13.66	0.166*

Independent sample t-test; ¶chi-square test. SD: Standard deviation

TABLE 2: Pre-operative and post-operative values of dermatochalasis patients

	Pre-op values of patients' (n=70) X̄±SD	Post-op values of patients' (n=70) X̄±SD	p value
IOP (mm/Hg)	**13.41±1.53**	**15.80±1.33**	**0.001***
K1 (D)	42.48±0.94	42.51±1.07	0.835
K2 (D)	**44.25±0.86**	**43.77±1.22**	**0.001***
Km (D)	43.48±0.72	42.75±0.56	0.275
CA (D)	**1.79±1.46**	**1.20±1.17**	**0.001***
ACD (mm)	2.26±0.11	2.36±0.14	0.101
AL (mm)	23.70±0.50	23.60±0.50	0.793
Lens thickness (mm)	4.10±0.30	4.00±0.30	0.140
IOL power (D)			
SRK/T (D)	21.50±1.40	21.40±1.40	0.346
SRK II (D)	22.00±1.50	22.10±1.40	0.347
Haigis (D)	21.50±1.30	21.00±1.50	0.304
Holladay 2 (D)	21.50±1.20	21.50±1.40	0.370
Hoffer Q (D)	22.00±1.30	22.00±1.50	0.079
Barret II (D)	21.50±1.50	22.00±1.30	0.316

*Statistically significant; bold values indicate statistically significant values. SD: Standard deviation; IOP: Intra ocular pressure K1: Flattest keratometry; K2: Steepest keratometry; Km: Mean keratometry; CA: Corneal astigmatism; ACD: Anterior chamber depth; AL: Axial length; IOL: Intraocular lens

TABLE 3: Pre-operative and post-operative values of unilateral ptosis patients'

	Pre-op values of patients' (n=40) X̄±SD	Post-op values of patients' (n=40) X̄±SD	p value
IOP (mm/Hg)	**15.10±1.40**	**17.80±2.12**	**0.001***
K1 (D)	42.23±1.05	42.51±1.09	0.329
K2 (D)	**44.12±0.68**	**42.07±0.80**	**0.001***
Km (D)	**43.53±0.84**	**41.25±0.79**	**0.001***
CA (D)	**3.09±2.93**	**2.27±2.55**	**0.001***
ACD (mm)	3.31±0.12	3.35±0.13	0.645
AL (mm)	23.71±0.60	23.61±0.61	0.087
Lens thickness (mm)	3.90±0.50	3.92±0.21	0.124*
Lens power (D)			
SRK/T (D)	**23.16±1.08**	**23.75±1.06**	**0.001***
SRK II (D)	**22.90±1.07**	**23.90±1.01**	**0.001***
Haigis (D)	**22.05±0.92**	**22.97±1.05**	**0.001***
Holladay 2 (D)	**22.00±1.40**	**22.70±1.20**	**0.032***
Hoffer Q (D)	**21.90±1.55**	**22.90±1.00**	**0.034***
Barret II (D)	**22.03±1.21**	**21.57±0.82**	**0.001***

*Statistically significant; bold values indicate statistically significant values. SD: Standard deviation; IOP: Intraocular pressure; K1: Flattest keratometry; K2: Steepest keratometry; Km: Mean keratometry; CA: Corneal astigmatism; ACD: Anterior chamber depth; AL: Axial length

In the ptosis group, postoperative measurements indicated an increase in IOP (p<0.001). Additionally, postoperative K2, Km, and CA values showed a significant decrease (p<0.001 for all). Moreover, all IOL power calculations made with different formulas showed decrease in measurements (p<0.001 for all). Pre- and post-operative values of ptosis patients are represented in Table 3.

DISCUSSION

Previous studies have investigated the impact of various eyelid surgeries on vision and corneal shape and found some substantial changes.[4,5,10] The impact of these alterations in corneal morphology and upon optic biometry have received some attention, however, no comparison been made before both of dermatochalasis and ptosis patients in the longer period like 6 months post-operatively when patients can undergo cataract surgery securely. Given the close link between corneal parameters and UE position it is feasible that these modifications could also result in alterations in anterior segment parameters.[4,8,14]

According to the previous studies, procedures performed on UEs can alter the applied pressure on the cornea and corneal curvature.[10,15,16] In the current study, the initial hypothesis was that mild UE droop caused by dermatochalasis, which does not significantly affect the visual field other than causing a minor defect in the upper quadrant, would not influence the corneal curvature or exert as much pressure on the corneal surface as severe UE ptosis. Consequently, it was hypothesized that mild UE droop would not interfere with keratometry values or IOL power calculations. The study's results indicated that UE position had a significantly decreasing effect on both CA and K2 values in both groups. Additionally, Km values were also reduced following ptosis correction via ALR surgery. These results indicate a reduction in steepness and irregularities on the corneal surfaces following the operations. Keratometry values' alterations after UE surgeries were investigated in previous studies as well, despite obtaining a consensus, some studies have similar outcomes like the current study. Zinkernagel et al. divided patients undergoing dermatochalasis or ALR surgery into groups based on the type of procedure: ptosis correction by ALR surgery and blepharoplasty with skin and fat pad removal.[17] Three months postoperatively, significant changes in CA values were observed in both of the groups. Another recent study with similar results which evaluated ocular biometric parameters after ptosis surgery demonstrated that 3 months after ALR surgery values of K1, K2, and CA decreased without depending on the amount of UE drop pre-operatively.[11] Furthermore, another similar study showed changes in K2 values in the post-operative 1st month after levator advancement surgery.[15]

Our results showed that in both of the groups IOP values exhibited significant increase in the sixth post-operative month, however, still remained within normal limits. Older patients who undergo corrective surgeries for UE malposition are more likely to develop IOP increases in the early post-operative period since the frequencies of both conditions would rise with age.[1,18] The removal of excess skin from patients undergoing UE procedures causes changes in the distribution of tissue around the eye and stretches the skin on the top of the eyelids.[19] This may result in an increased amount of tissue being confined to the same space, which could raise the tension in the tissue around the eye.[19] An important consideration following UE surgery is the potential impact on IOP, particularly in glaucoma patients. Previous studies have reported an average increase in IOP after UE procedures after shorter postoperative periods, which could pose a risk for individuals with compromised optic nerve function.[19] *Although our study focused on optical biometry parameters and evaluated findings at the 6-month postoperative mark, it is important to consider that early and late postoperative IOP fluctuations may have occurred which could have some detrimental effects for patients who has glaucoma or risk factors for its development. These findings highlight the need for careful preoperative assessment and postoperative monitoring of IOP, particularly in glaucoma patients and patients with borderline IOP readings or has risk factors. Further research is warranted to explore the long-term implications and early postoperative IOP changes following UE surgery.*

Our result for patients with dermatochalasis complied with the literature, however, there are not enough studies evaluating IOP changes in ptosis patients in a period longer than 3 months.[8,11,19] In Aydemir and Aksoy Aydemir study, ptosis patients were divided into 3 subgroups based on the severity of UE position.[11] Although IOP values increased post-operatively, the changes were not statistically significant. In order to understand the effect of surgical UE ptosis correction on IOP values, conducting studies with more participants and closer evaluations would be beneficial.

AL and corneal keratometry represent variables that exert a crucial influence on IOL power calculations.[20] It is thoroughly established that the cornea's shape is influenced by the UE's pressure on it so that the timing of the procedures are quite concerning, as this pressure can alter the corneal curvature, consequently impacting the IOL power calculation for cataract surgery.[21] As IOL formulas have advanced, achieving precise target refractions has become more attainable. Nevertheless, even with these technological advancements in standardizing and refining IOL power calculation methods, it may still be impossible to reach a mean absolute error of zero for every cataract surgery patient, even for those without any UE position impairments.[20] Our results for patients undergoing blepharoplasty indicated no significant difference between pre-operative and post-operative IOL power calculations, which contrasts with current literature findings.[9] In the group of patients with dermatochalasis, a difference of approximately 0.75 D was observed in the mean K2 values postoperatively. Given the formulas used for IOL calculation, this change would be expected to result in a refractive difference of approximately 0.50 D. However, despite these changes, no statistically significant difference was observed in IOL power calculations. In this study, the greatest IOL power variation was noted with the Barrett Universal II formula. Previous literature has demonstrated that the Barrett Universal II formula provides the most accurate IOL calculations and has superiority on prediction of postoperative refractive errors compared to other formulas, including Haigis, Hoffer Q, Holladay 1, and SRK/T.[22] Additionally, priorly it has been shown that ACD and AL are as crucial as keratometry values in IOL power calculations.[22] In this study, the findings may be attributed to postoperative ocular surface changes, while other parameters influencing IOL calculations, such as ACD, AL, and even lens thickness LT, remained almost unchanged.

According to the current study's outcomes when planning levator surgery for patients who have previously undergone cataract surgery, potential changes in refraction should be considered. Eyelid position can influence corneal curvature, anterior chamber depth, and ocular surface regularity, all of which may contribute to subtle refractive changes.[5,21] While our study did not specifically evaluate postoperative refractive shifts, previous research suggests that ptosis correction can induce minor alterations in astigmatism and spherical equivalent.[23] Surgeons should inform patients about the possibility of such changes, particularly those with premium IOLs or a history of refractive surgery, where even small variations may affect visual outcomes.[20] Preoperative assessment, including corneal topography and careful biometry, may help anticipate and minimize unexpected refractive shifts.[22] Further studies are needed to quantify these effects and establish guidelines for counseling patients undergoing levator surgery after cataract extraction.

Although the published data on this patient group is limited, 2 published studies demonstrated a decrease in IOL power calculations three and 6 months post-operatively using the same calculation formulas applied in our study.[9,24] The discrepancies between our findings and those of previous studies may be attributed to differences in sample size, bilateral eye evaluation, and the positions of UEs. In the current study, only eyes with a MRD1 greater than 4 mm were included, and no fat pad removal was performed during the surgeries. Moreover, our study's larger patient cohort enhances the validity of our findings and represents its strength. In patients with unilateral ptosis, data in the literature are notably scarce. Only 1 published study has examined IOL power 3 months following ALR surgery, demonstrating significant decreases in IOL power calculations as calculated by various formulas.[11] This current study is the first to evaluate biometric parameters over a longer-term following ptosis correction. Further research with larger cohorts and extended follow-up periods is necessary to elucidate the optimal sequence and timing of cataract and UE surgeries.

To the best of the authors' knowledge, this is the first study to quantitatively and systematically examine optical biometric alterations after both external levator advancement and UE blepharoplasty surgeries 6 months post-operatively. This study has some limitations that should be considered when interpreting the results. First limitation is exclusion of patients with congenital ptosis, focusing instead on those with secondary ptosis and normal levator muscle function to achieve more homogenous results and specifically to evaluate patients who can undergo cataract surgery. This exclusion limits the generalizability of our findings to the broader ptosis patient population. Second, we did not include patients undergoing Müller muscle-conjunctival resection or frontalis suspension surgeries. This decision was made to isolate and understand the exact influence of one specific type of surgery, but it also means that our results may not applicable to other patients receiving those other common procedures. The last limitation of the study was not assessing values affecting the ocular surface, such as the quality of the tear film and its effect on the ocular surface, which can be affected after these surgeries. These changes can lead to significant alterations in keratometric values and biometric measurements. Finally, our study did not assess short-term results, as we aimed to evaluate outcomes at a time more suitable for cataract surgery. Consequently, our findings do not reflect the immediate postoperative period, which could be relevant for patient care and early intervention strategies.

CONCLUSION

In conclusion, our results indicate that ptosis correction via the ALR procedure significantly impacts IOL power calculations, while both blepharoplasty and ALR surgeries notably still affect corneal curvature and optical biometry in the longer postoperative period. These findings are particularly relevant given the increasing number of cataract and UE position correction surgeries in older patients. The potential clinical impact of UE surgeries on these patients underscores the need for careful consideration of the timing and sequencing of cataract and UE procedures. Future studies are essential to further elucidate these interactions and optimize patient outcomes.

Source of Finance

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:** Nazan Acar Eser; **Design:** Nazan Acar Eser; **Control/Supervision:** Nazan Acar Eser, Kübra Serbest Ceylanoğlu, Emine Malkoç Şen; **Data Collection and/or Processing:** Nazan Acar Eser, Kübra Serbest Ceylanoğlu, Emine Malkoç Şen; **Analysis and/or Interpretation:** Nazan Acar Eser, Kübra Serbest Ceylanoğlu, Emine Malkoç Şen; **Literature Review:** Nazan Acar Eser, Kübra Serbest Ceylanoğlu, Emine Malkoç Şen; **Writing the Article:** Nazan Acar Eser; **Critical Review:** Kübra Serbest Ceylanoğlu, Emine Malkoç Şen; **References and Fundings:** Nazan Acar Eser, Kübra Serbest Ceylanoğlu, Emine Malkoç Şen; **Materials:** Nazan Acar Eser, Kübra Serbest Ceylanoğlu, Emine Malkoç Şen; **Other:** Kübra Serbest Ceylanoğlu, Emine Malkoç Şen.*

REFERENCES

1. Bacharach J, Lee WW, Harrison AR, Freddo TF. A review of acquired blepharoptosis: prevalence, diagnosis, and current treatment options. Eye (Lond). 2021;35(9):2468-81. PMID: 33927356; PMCID: PMC8376882.
2. Meyer DR, Stern JH, Jarvis JM, Lininger LL. Evaluating the visual field effects of blepharoptosis using automated static perimetry. Ophthalmology. 1993;100(5):651-8; discussion 658-9. PMID: 8493006.
3. Riemann CD, Hanson S, Foster JA. A comparison of manual kinetic and automated static perimetry in obtaining ptosis fields. Arch Ophthalmol. 2000;118(1):65-9. PMID: 10636416.
4. Simsek IB, Yilmaz B, Yildiz S, Artunay O. Effect of upper eyelid blepharoplasty on vision and corneal tomographic changes measured by pentacam. Orbit. 2015;34(5):263-7. PMID: 26186387.
5. Read SA, Collins MJ, Carney LG. The influence of eyelid morphology on normal corneal shape. Invest Ophthalmol Vis Sci. 2007;48(1):112-9. PMID: 17197524.
6. Giglio R, Vinciguerra AL, Presotto M, Jonak K, Rejdak R, Toro MD, et al. Visual outcomes and patient satisfaction after bilateral implantation of an enhanced monofocal intraocular lens: a single-masked prospective randomized study. Int Ophthalmol. 2024;44(1):112. PMID: 38407686; PMCID: PMC10896881.
7. Xia T, Martinez CE, Tsai LM. Update on intraocular lens formulas and calculations. Asia Pac J Ophthalmol (Phila). 2020;9(3):186-93. PMID: 32501896; PMCID: PMC7299214.
8. Koc H, Ozen S, Bayram U, Kanik A. Evaluation of early period changes in intraocular pressure, ocular biometry and anterior segment after upper eyelid blepharoplasty. Int Ophthalmol. 2024;44(1):2. PMID: 38315421.
9. Vola ME, Lisboa R, Diniz ER, Pereira NC, Kanecadan RT, Forseto ADS. Influence of upper blepharoplasty on intraocular lens calculation. Arq Bras Oftalmol. 2021;84(1):11-6. PMID: 33470336.
10. Altin Ekin M, Karadeniz Ugurlu S. Prospective analysis of visual function changes in patients with dermatochalasis after upper eyelid blepharoplasty. Eur J Ophthalmol. 2020;30(5):978-84. PMID: 31203659.
11. Aydemir E, Aksoy Aydemir G. Ptosis effects on intraocular lens power calculation. J Cataract Refract Surg. 2023;49(2):171-6. PMID: 36148816.
12. Liang YL, Jia SB. Clinical application of accommodating intraocular lens. Int J Ophthalmol. 2018;11(6):1028-37. PMID: 29977819; PMCID: PMC6010372.
13. Cheng J, Kong X, Xiao M, Sun X. Twenty-four-hour pattern of intra-ocular pressure in untreated patients with primary open-angle glaucoma. Acta Ophthalmol. 2016;94(6):e460-7. PMID: 26843038.
14. Stopyra W, Langenbucher A, Grzybowski A. Intraocular lens power calculation formulas-a systematic review. Ophthalmol Ther. 2023;12(6):2881-902. PMID: 37698825; PMCID: PMC10640516.
15. Aksu Ceylan N, Yeniad B. Effects of upper eyelid surgery on the ocular surface and corneal topography. Turk J Ophthalmol. 2022;52(1):50-6. PMID: 35196840; PMCID: PMC8876776.
16. Sommer F, Untch E, Spoerl E, Herber R, Pillunat LE, Terai N. Effect of upper eyelid blepharoplasty on corneal biomechanical, topographic and tomographic parameters 4 weeks after surgery. Int Ophthalmol. 2022;42(1):113-21. PMID: 34478004; PMCID: PMC8803703.
17. Zinkernagel MS, Ebneter A, Ammann-Rauch D. Effect of upper eyelid surgery on corneal topography. Arch Ophthalmol. 2007;125(12):1610-2. PMID: 18071108.
18. Kapetanakis VV, Chan MP, Foster PJ, Cook DG, Owen CG, Rudnicka AR. Global variations and time trends in the prevalence of primary open angle glaucoma (POAG): a systematic review and meta-analysis. Br J Ophthalmol. 2016;100(1):86-93. PMID: 26286821; PMCID: PMC4717368.
19. Osaki TH, Osaki MH, Ohkawara LE, Osaki T, Gameiro GR, Melo LAS Jr. Possible influence of upper blepharoplasty on intraocular pressure. Ophthalmic Plast Reconstr Surg. 2020;36(4):346-8. PMID: 32658133.
20. Gupta V, Pal H, Sawhney S, Aggarwal A, Vanathi M, Luthra G. Optimization of biometry for best refractive outcome in cataract surgery. Indian J Ophthalmol. 2024;72(1):29-43. PMID: 38131567; PMCID: PMC10841781.
21. Lieberman DM, Grierson JW. The lids influence on corneal shape. Cornea. 2000;19(3):336-42. PMID: 10832695.
22. Kim JW, Eom Y, Yoon EG, Choi Y, Song JS, Jeong JW, et al. Algorithmic intraocular lens power calculation formula selection by keratometry, anterior chamber depth and axial length. Acta Ophthalmol. 2022;100(3):e701-e709. PMID: 34378871; PMCID: PMC9292369.
23. Mongkolareepong N, Mekhasingharak N, Pimpha O. Factors associated with corneal astigmatism change after ptosis surgery. Int J Ophthalmol. 2022;15(4):576-80. PMID: 35450188; PMCID: PMC8995722.
24. Ilhan C, Aydemir GA, Aydemir E. Changes in intraocular pressure and ocular biometry after blepharoplasty. Aesthetic Plast Surg. 2022;46(5):2295-300. PMID: 35018494.