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ORIGINAL ARTICLE

Medicine Science International Medical Journal

Medicine Science 2025;14(4):1008-11

Corneal topographic parameters changes after upper eyelid blepharoplasty: A prospective longitudinal study

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Received 03 March 2025; Accepted 23 June 2025
Available online 06 October 2025 with doi: 10.5455/medscience.2025.02.064

Abstract

In a six-month follow-up, we aimed to determine the upper eyelid skin-only excision blepharoplasty technique on corneal biomechanics. Corneal anterior and posterior surface keratometry values (flat, steep, and mean keratometry, minimum radius of curvature), cylindrical power and axis, corneal volume, anterior chamber volume, and anterior chamber depth were compared. At the sixth month after surgery, the mean anterior cylindrical power, flat, steep, and mean keratometry values decreased significantly compared to preoperative values (p= 0.018, p=0.015, p=0.006, p=0.005, respectively). The mean corneal volume, anterior chamber volume, anterior chamber depth, and corneal posterior biomechanical parameters were not significantly affected. The upper eyelid skin-only excision blepharoplasty improved anterior corneal astigmatism and keratometry values.

Keywords: Blepharoplasty, corneal biomechanics, cylindrical power, flat keratometry, steep keratometry

Introduction

Dermatochalasis is characterized by increased eyelid skin laxity and slimming of connective tissue due to aging, eyelid rubbing, trauma, and inflammatory or infectious eyelid diseases [1-4]. Upper eyelid blepharoplasty has been performed worldwide for cosmetic and medical reasons, such as to enlarge the visual field and relieve extended skin-related eyelid and eyelash irritation [5].

Surgical techniques, such as excision of the skin-only, orbicularis muscle, and fat pad, may vary according to the patient's expectations and medical requirements.

The effects of dermatochalasis surgery on the ocular and anterior segments varied depending on surgery techniques [6,7]. In a six-month follow-up, this prospective longitudinal study aimed to determine the upper eyelid skin-only excision blepharoplasty technique on corneal biomechanics.

Material and Methods

We planned to follow prospectively 78 eyes of 39 patients, aged 33 to 83, for six months. We compared preoperative and postoperative first and sixth-month corneal biomechanical parameters. The same expert recorded preoperative, postoperative first, and sixth-month images with non-dilated pupils in the 150-200 lux photopic condition using the Pentacam Scheimpflug camera (OCULUS Optikgeräte GmbH, Wetzlar, Germany). Corneal anterior and posterior surface keratometry values (flat keratometry [K1], steep keratometry [K2], mean keratometry [Km], minimum radius of curvature [Rmin]), cylindrical power and axis (Cpwr, Ax), corneal volume (CV), anterior chamber volume (ACV), anterior chamber depth (ACD) were compared.

We included patients with sagging eyelid skin that narrowed the visual field and caused upper eyelid skin and eyelash irritation. Patients with eyelid abnormalities, such as ptosis, entropion,

CITATION
Karabulut S, Karabulut M. Corneal topographic parameters changes after upper eyelid blepharoplasty: A prospective longitudinal study. Med Science. 2025;14(4):1008-11

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DOI: 10.5455/medscience.2025.05.115

ectropion, trichiasis, eyelid inflammatory or infectious diseases, lacrimal secretory and drainage system diseases (dacryoadenitis, dacryocystitis), conjunctival or corneal pathologies, glaucoma, and a history of previous ocular and eyelid surgery were omitted. We also excluded images with quality scores less than 95% and patients who had ocular surgery during the study and did not attend their postoperative visits.

All surgeries were performed by the same experienced oculoplastic surgeon (MK). The amount of skin excision was determined by drawing and pinch test in the sitting position before surgery. The lower border was approximately 8-10 mm away from the eyelid margin, extending from the upper lacrimal punctum to the lateral edge of the upper eyelid, depending on the eyelid crease. To determine the upper border of the sagging skin, a line was marked from the upper lacrimal punctum to the point 10 mm away from the lateral canthal angle, leaving at least 10 mm distance from the lower border of the eyebrow. Figure 1 demonstrates the preoperative drawing. The skin was pinched using ophthalmic forceps to check whether the amount was sufficient. Special care was taken to avoid postoperative lagophthalmos.

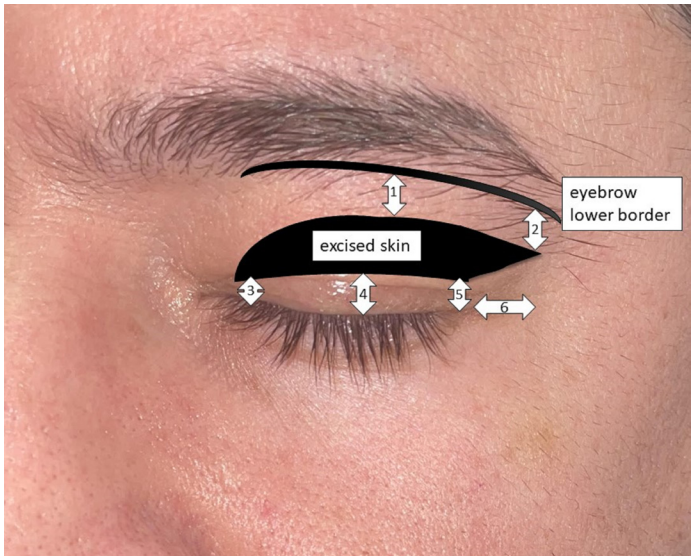

Figure 1. Demonstrates the borders of excised skin. About 10 mm distance remained between the eyebrow's lower border and the excised skin's upper border (arrows 1 and 2). The medial (arrow 3), middle (arrow 4), and lateral (arrow 5) distances between excised skin's and tarsal plate's lower borders are 5-7 mm, 8-10 mm, and 6-8 mm, respectively, depending on the upper eyelid crease. The medial pole of excised skin begins at the level of the upper punctum, and the upper border extends 10 mm away from the lateral cantal angle (arrow 6), while the lower one ends at the level of the lateral cantal angle.

After cleaning and draping the surgery side, 1% lidocaine with 1:100,000 epinephrine was injected subcutaneously. Only the skin was excised with a Westcott scissors without crossing the borders. We did not remove fat pads or orbicularis oculi in these patients. Bipolar catheterization was utilized to control hemorrhages. Two brassiere sutures were applied laterally to fixate the orbicularis to the orbital rim with a 5.0 polyglactin absorbable suture. The skin was sutured subcutaneously with a non-absorbable 6.0 polypropylene suture. A neomycin sulfate/bacitracin combination ointment two times a day was prescribed for about two weeks. A cold compress and sleeping with two pillows were recommended for about three days. Oral non-steroids were permitted if needed. The non-absorbable polypropylene suture was removed in the first week after surgery.

Continuous and categorical variables were recorded using the Statistical Package for the Social Sciences version 25 (IBM Corporation, 1989, 2017, Chicago, U.S.) and presented as means ± standard deviations and numbers/percentages. After confirming the normal distribution of variables using the Shapiro-Wilk test, a paired sample t-test was used to compare the parameters. A p-value under 0.05 indicated statistical significance.

The İzmir Bakırçay University Ethics Committee approved the study on September 18, 2024, with protocol/decision numbers 1748 and 1768. All patients provided written informed consent, and the Declaration of Helsinki principles were followed throughout the study.

Results

Thirty-two patients completed the study. Seven patients were excluded during the study period: two for failing to attend postoperative visits and five for intraocular surgery. Fourteen patients were male (44%), and 18 were female (56%). The mean age was 53.56 ± 10.82 years (ranged 33 to 83 years). No postoperative complications (lagophthalmos, skin infections, massive hemorrhage, ecchymosis and edema, wound dehiscence, scar hypertrophy) were observed in any patient.

Corneal anterior biomechanical parameters did not change significantly in the first postoperative month compared to baseline (Table 1). In the sixth month after surgery, the mean anterior Cpwr, K1, K2, and Km values decreased significantly compared to preoperative values (p= 0.018, p=0.015, p=0.006, p=0.005, respectively) (Table 1). The mean CV, ACV, ACD, and corneal posterior biomechanical parameters were not significantly affected (Table 2).

Discussion

The skin weight and laxity in the upper eyelid may pressure the eyeball, leading to changes in the biomechanical parameters of the cornea [6, 8]. Alterations in these parameters are important in affecting intraocular pressure measurement and prediction of corneal surface and lenticular surgery results [9].

DOI: 10.5455/medscience.2025.05.115

Table 1. Changes in corneal anterior biomechanical parameters (n=64)

	Preop	Post-op first month	Post-op six month	P^A	P^B	P^C
	Mean ± SD					
Cpwr (D)	0.89 ± 0.41	0.84 ± 0.45	0.80 ± 0.41	0.204	**0.018**	0.460
K1 (D)	42.70 ± 3.65	42.57 ± 1.97	42.23 ± 5.64	0.671	**0.015**	0.804
K2 (D)	43.83 ± 1.89	43.72 ± 2.07	43.64 ± 1.95	0.146	**0.006**	0.272
Km (D)	43.38 ± 1.85	43.29 ± 2.01	43.23 ± 1.89	0.116	**0.005**	0.506
Rmin(mm)	7.55 ± 0.31	7.57 ± 0.28	7.59 ± 0.28	0.234	0.105	0.189
Ax(degree)	96.06 ± 67.96	95.03 ± 67.23	95.87 ± 68.85	0.468	0.578	0.375

A paired sample t-test was used for pairwise comparisons. PA: Preop vs. post-op first month; PB: Preop vs. post-op sixth month; PC: Post-op first month vs. post-op sixth month. The significant p-values are shown in bold.
Ax: Cylindrical axis; Cpwr: Cylindrical power; D: Diopter; K1: Flat keratometry; K2: Steep keratometry; Km: Mean keratometry; mm: Millimeter; n: Number; P: p-value; Post-op: Postoperative; Preop: Preoperative; Rmin: Minimum radius of curvature; SD: Standard deviation

Table 2. Changes in ACD, ACV, CV, and corneal posterior biomechanical parameters

	Preop	Post-op first month	Post-op six month	P^A	P^B	P^C
	Mean ± SD					
Cpwr (D)	0.31 ± 0.11	0.30 ± 0.15	0.30 ± 0.11	0.234	0.202	0.901
K1 (D)	-6.12 ± 0.24	-6.13 ± 0.24	-6.12 ± 0.24	0.870	0.368	0.361
K2 (D)	-6.43 ± 0.22	-6.43 ± 0.23	-6.43 ± 0.24	0.758	0.679	0.702
Km (D)	-6.27 ± 0.22	-6.27 ± 0.21	-6.26 ± 0.22	0.655	0.175	0.158
Rmin(mm)	6.07 ± 0.22	6.08 ± 0.27	6.09 ± 0.23	0.174	0.132	0.145
Ax(degree)	95.48 ± 79.45	95.56 ± 79.54	96.28 ± 79.43	0.198	0.171	0.296
CV (mm3)	59.51 ± 3.31	58.77 ± 7.45	59.48 ± 3.14	0.209	0.503	0.309
ACV(mm3)	137.17 ±36.76	136.02 ±39.36	137.83 ±37.53	0.734	0.809	0.620
ACD(mm)	2.66 ± 0.40	2.74 ± 16.67	2.65 ± 0.37	0.697	0.923	0.744

A paired sample t-test was used for pairwise comparisons. PA: Preop vs. post-op first month; PB: Preop vs. post-op sixth month; PC: Post-op first month vs. post-op sixth month. The significant p-values are shown in bold.
ACD: Anterior chamber depth; ACV: Anterior chamber volüme; Ax: Cylindrical axis; Cpwr: Cylindrical power; CV: Corneal volüme; D: Diopter; K1: Flat keratometry; K2: Steep keratometry; Km: Mean keratometry; mm: Millimeter; mm3: Cubic millimeter; n: Number; P: p-value; Post-op: Postoperative; Preop: Preoperative; Rmin: Minimum radius of curvature; SD: Standard deviation.

These important questions need to be answered: Which side and structure of the cornea is more affected, and how are these biomechanical parameters changed after blepharoplasty surgery?

Most of the reports showed the anterior surface was more affected. However, various results have been reported. Simsek IE et al. found a significant increase in anterior corneal astigmatism after blepharoplasty surgery [10]. Altın Ekin M et al. showed a substantial improvement [11]. Aksu Ceylan N et al. detected no significant changes [12]. We found a significant decrease in anterior corneal astigmatism. The posterior surface of the cornea was not affected.

Corneal keratometry is the other biomechanical parameter that may change after blepharoplasty surgery. Our study showed that the upper eyelid skin-only excision blepharoplasty improved anterior Cpwr, K1, K2, and Km values. Additionally, the corneal posterior biomechanical parameters were not significantly affected. Dogan L et al. reported a significant increase in K2 value after upper eyelid blepharoplasty surgery [13]. However, they removed the orbicularis oculi in their surgery. Nalcı et al. found no changes after upper eyelid blepharoplasty surgery [4]. Like our study, Zinkernagel MS et al. reported improved anterior corneal keratometry values [14]. To the best of our knowledge, there was no study reporting the posterior corneal keratometry values after upper eyelid blepharoplasty surgery. We also found that upper eyelid blepharoplasty did not affect CV, ACD, or ACV, which is consistent with previous studies [15].

This study has some limitations. We did not show the effects of fat pads or orbicularis oculi removal on corneal biomechanical parameters. We also did not compare ocular aberrations, visual quality, or dry eye symptoms.

Conclusion

In conclusion, blepharoplasty improved anterior corneal astigmatism and keratometry values in removing upper eyelid-

DOI: 10.5455/medscience.2025.05.115

only skin. These results should be considered when planning corneal or lenticular surgeries.

Conflict of Interests
The authors declare that there is no conflict of interest in the study.

Financial Disclosure
The authors declare that they have received no financial support for the study.

Ethical Approval
The İzmir Bakırçay University Ethics Committee approved the study on September 18, 2024, with protocol/decision numbers 1748 and 1768.

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