Impact on Tear Film Production after Upper Lid Blepharoplasty

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Abstract

Background: The global population is aging, leading to increased incidence of dermatochalasis, a condition affecting the upper eyelids due to age-related changes in levator palpebrae superioris function. Upper eyelid blepharoplasty is a common surgical intervention to correct dermatochalasis, involving excision of excess skin and fat. Despite its benefits, concerns about postoperative dry eye syndrome persist, highlighting the need for further research in this area.

Design: This prospective cohort study aimed to evaluate the impact of upper eyelid blepharoplasty on tear production and stability in patients with dermatochalasis. Ten eyes from five female patients (mean age 69.50 ± 8.26 years) were included. Tear assessments were conducted preoperatively and at 2, 6, and 12 weeks postoperatively using the Schirmer test and tear breakup time (TBUT).

Methods: Patients scheduled for upper eyelid blepharoplasty were recruited at Thammasat University Hospital. Examinations included best-corrected visual acuity, slit-lamp biomicroscopy, intraocular pressure, Schirmer test, and TBUT. Exclusion criteria encompassed concurrent corneal diseases and certain pre-existing eye conditions.

Results: There were no statistically significant differences in Schirmer test measurements or TBUT between preoperative and postoperative assessments at 2, 6, and 12 weeks ($p > 0.05$). Mean Schirmer test values were 11.9 ± 8.99 mm preoperatively and 9.72 ± 3.55 mm at 12 weeks postoperatively. TBUT values were 9.11 ± 5.46 seconds preoperatively and 9.72 ± 3.55 seconds at 12 weeks postoperatively.

Conclusions: Upper eyelid blepharoplasty for dermatochalasis did not lead to significant changes in tear production or stability over a 12-week follow-up period. These findings suggest that careful surgical technique may preserve tear dynamics postoperatively. However, larger studies with diverse populations and longer follow-up durations are warranted to validate these results and assess potential long-term effects on ocular surface health.

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Introduction

Currently, better medical treatment makes people live longer. At present, the proportion of the population over 60 years old is found to be 11% of the total world population and is likely to increase by 22% in 2050,[1,2] thus inferring an increase in the detection of dermatochalasis due to age. This condition is caused by abnormalities of the aponeurosis of the levator palpebrae superioris which is associated with progressive age-related deterioration.[3,4] Dermatochalasis can be caused by several factors, such as gravity, ultraviolet radiation, and degeneration of non-adherent subcutaneous fat. These often cause the eyelids to fall unattractively and affect the mental state[5] or, in some cases, the eyelids are drooping to the point of obscuring the field of vision resulting in a narrower sight than before.

The most popular way to correct dermatochalasis is a surgery called upper eyelid blepharoplasty. The principle is to cut off the excess skin, some part of orbicularis oculi, and

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submuscular fat considered on a case-by-case basis depending on the nature of the patient. All steps are completed and sutured to close the wound.[6] The common complications include hematomas along the edge of the wound, uneven eyelid condition, lagophthalmos, and scar formation.[7,8] Other complications can be found, such as retrobulbar hemorrhage, or even a dry eye.[9]

Despite advancements in surgical techniques and perioperative care, studies examining the incidence and risk factors of dry eyes following upper blepharoplasty remain sparse. Existing literature primarily focuses on dry eye complications following other ophthalmic procedures or facial surgeries involving the eyelids.[10,11] This gap underscores the need for dedicated research to elucidate the prevalence, severity, and predictors of dry eyes specifically associated with upper blepharoplasty.

Understanding the implications of upper blepharoplasty on ocular surface health is crucial for several reasons. Firstly, dry eye symptoms can significantly impact patient satisfaction and quality of life postoperatively, potentially overshadowing the aesthetic benefits of the surgery.[12] Secondly, by identifying predisposing factors and modifiable surgical techniques, clinicians can optimize patient selection, improve surgical outcomes, and implement targeted preventive measures and management strategies.[13] Moreover, given the increasing demand for cosmetic eyelid surgery, particularly among aging populations, addressing ocular surface health concerns is paramount for ensuring safe and effective patient care.[14] Assuming that following upper eyelid blepharoplasty, there will be a significant decrease in tear production as measured by Schirmer test compared to preoperative levels, this study aims to quantify the extent of this decrease and evaluate its implications for postoperative ocular health.

This study aims to report the abnormalities of tear production after upper eyelid blepharoplasty. This results in corneal surface disease. There are no studies in Thailand and still produce unclear conclusions.

Method

This study was approved by the Human Research Ethics Committee of Thammasat University. We enrolled patients scheduled for upper eyelid blepharoplasty due to dermatochalasis. Informed consent was obtained from all participants, and all patients received care in strict accordance with the Helsinki Declaration. A comprehensive eye examination was conducted, which included assessment of best-corrected visual acuity, fundus examination, slit-lamp biomicroscopy, intraocular pressure (IOP), tear breakup time (TBUT), and Schirmer test.

The following indications were listed as reasons for upper eyelid blepharoplasty: excessive laxity with temporal hooding, constant frontalis muscle contraction in the presence of dermatochalasis and ptosis, and cosmetic concerns.[15]

The evaluation of tear production involves two variables: 1. Tear breakup time, measured in seconds using the Keratograph® 5M (K5M), which represents the capacity of the lipid layer production. 2. The Schirmer test measures tear quantity by inserting a specific test paper into the inferior fornix, waiting five minutes, and recording the result in millimeters.

Patients aged 18 to 80 years, scheduled for upper eyelid blepharoplasty at Thammasat University Hospital in December 2023 to correct dermatochalasis without additional procedures such as eyebrow or levator correction, performed by a single surgeon, were included. Patients with concurrent corneal issues including autoimmune disease, contact lens wearers, those using more than 4 drops of preoperative/postoperative artificial tears per day, using other eye medications, or who had undergone any corneal corrective surgeries, including refractive surgery, were excluded from the study. After applying these criteria, a total of 5 patients (10 eyes) were recruited.

The sample size was calculated using Turker IC[16] with an alpha of 0.05 and 90% power, employing the ANOVA method. The estimated required sample size was 10 eyes.

The Schirmer test and K5M were regularly used to assess tear production capacity in all patients. These evaluations were conducted on the day of surgery (pre-surgery) and at 2, 6, and 12 weeks postoperatively. Soft tissue edema typically peaks at 10-14 days postoperatively and diminishes notably by 6 weeks, with complete resolution around 12 weeks postoperatively. All examinations were conducted by a single

ophthalmology resident. Patients were tested 30 minutes before being sent to the operating room (OR), during which they were not allowed to use artificial tears for 1 hour before the test. Data analysis was performed using the paired t-test.[17]

Statistical analysis was conducted using paired t-tests for normally distributed data and the Wilcoxon signed-rank test for non-normally distributed data. We assessed whether there were statistically significant differences in mean values between preoperative measurements and measurements at 12 weeks postoperatively, which constituted the primary outcome for tear production. Secondary outcomes included comparisons between preoperative and postoperative measurements at 2 weeks and 6 weeks, as well as among postoperative measurements at 2 weeks, 6 weeks, and 12 weeks. P values less than 0.05 were considered statistically significant. Statistical analyses were performed using SPSS statistics version 20.0.

Results

Data were collected from 10 eyes across 5 patients. All participants were women. The average age was 69.50 ± 8.26 years. As indicated in Tables 1 and 2, the mean preoperative of the Schirmer at baseline was 11.9 ± 8.99 mm., and the mean TBUT was 9.11 ± 5.46 seconds.

Table 1: Schirmer test

Schirmer test	Mean	SD
Schirmer baseline	11.9	8.99
Schirmer 2 W post- operative*	5 (4, 9)	
Schirmer 6 W post-operative	8.4	2.80
Schirmer 12 W post- operative	9.5	4.53

* Median (p25, p75); W weeks

Table 2: Tear breakup time (TBUT)

TBUT	Mean	SD
TBUT baseline	9.11	5.46
TBUT 2 W post-operative*	8.03 (5.1, 17.49)	
TBUT 6 W post-operative	10.33	5.67
TBUT 12 W post-operative	9.72	3.55

* Median (p25, p75); W weeks

Table 3 shows no statistically significant difference between the initial Schirmer test and the 12-week postoperative period. Additionally, every comparison in Schirmer shows no association. Although there was some difference in the mean between baseline Schirmer and 12 weeks postoperative (baseline Schirmer 11.9 ± 8.99 mm versus 12 weeks postoperatively 9.72 ± 3.55 mm), there was no statistically significant difference (P value > 0.05).

Additionally, Table 4 demonstrating the value of TBUT at 2, 6, and 12 weeks failed to reveal statistical significance. This study noted no problems like eyelid retractions, blepharoptosis, retrobulbar hemorrhage, or reoperations.

Table 3: Statistical analysis of paired differences of the Schirmer test

Paired differences	Mean	SD	95% confidence interval		P value
			Lower	Upper	
Schirmer baseline vs Schirmer 2 W					0.59
Schirmer baseline vs Schirmer 6 W	3.5	7.88	-2.14	9.14	0.19
Schirmer baseline vs Schirmer 12 W	2.4	9.75	-4.58	9.38	0.46
Schirmer 2 W vs Schirmer 6 W					0.58
Schirmer 2 W vs Schirmer 12 W					0.95
Schirmer 6 W vs Schirmer 12 W	-1.1	4.15	-4.07	1.87	0.42

W weeks

Table 4: Statistical analysis of paired differences in Tear breakup time (TBUT)

Paired differences	Mean	SD	95% confidence interval		P value
			Lower	Upper	
TBUT baseline vs TBUT 2 W					0.20
TBUT baseline vs TBUT 6 W	-1.22	2.78	-3.21	0.77	0.20
TBUT baseline vs TBUT 12 W	-0.60	4.63	-3.91	2.71	0.69
TBUT 2 W vs TBUT 6 W					0.72
TBUT 2 W vs TBUT 12 W					0.51
TBUT 6 W vs TBUT 12 W	0.62	4.49	-2.60	3.83	0.68

W weeks

Discussion

This study investigated the effects of upper eyelid blepharoplasty for dermatochalasis on tear production and tear break-up time (TBUT) in a cohort of 10 eyes from 5 female patients, with an average age of 69.50 ± 8.26 years. Preoperative assessments revealed a mean Schirmer test measurement of 11.9 ± 8.99 mm and a mean TBUT of 9.11 ± 5.46 seconds. Postoperative evaluations at 2, 6, and 12 weeks showed no statistically significant changes in either the Schirmer test results or TBUT compared to preoperative measurements.

The findings indicate that surgical correction of dermatochalasis through upper eyelid blepharoplasty did not lead to a detrimental impact on tear production or tear film stability in the immediate postoperative period. These results are consistent with studies that have similarly reported minimal disruption to tear dynamics following cosmetic eyelid surgeries.[18,19]

The preservation of tear function postoperatively can likely be attributed to the surgical technique employed, which typically involves conservative excision of excess skin and consideration of individual anatomical variations without extensive manipulation of the orbicularis oculi muscle. This approach minimizes potential disruptions to the lacrimal functional unit responsible for tear production and distribution.

However, the study is limited by its small sample size and the homogeneous nature of the patient population, primarily consisting of older female individuals. Generalizability to broader demographics and variations in surgical techniques may be constrained. Additionally, the follow-up period of 12 weeks may not capture potential long-term changes in tear function or ocular surface health that could arise beyond this timeframe.

Future research could benefit from larger, more diverse cohorts and extended follow-up periods to further elucidate the long-term effects of upper eyelid blepharoplasty on tear dynamics. Incorporating additional objective measures such as tear osmolarity and ocular surface staining could provide a comprehensive assessment of postoperative ocular health and identify subclinical changes in tear function that may not be apparent with conventional tests alone.

In conclusion, while this study found no significant alterations in tear production or TBUT following upper eyelid blepharoplasty for dermatochalasis, ongoing vigilance and personalized patient management remain essential to optimize postoperative outcomes and ensure ocular surface health.

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