ORIGINAL ARTICLE

EVALUATION OF DRY EYE AND MEIBOMIAN GLAND DYSFUNCTION IN CASES OF UNILATERAL BLEPHAROPTOSIS

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Abstract

Introduction: Dry eye is a prevalent public health issue among the geriatric population. When accompanied by blepharoptosis, it carries the potential for complications.

Materials and Method: The study involved the evaluation of dry eye survey scores, dry eye tests, and the structure of meibomian glands by meibography in 25 cases of unilateral blepharoptosis. Comparisons were made between ptotic and non-ptotic eyes. In addition, measurements of levator function, palpebral fissure distance, and margin reflex distance were recorded for both ptotic and non-ptotic eyes, and the relationships between these parameters were analyzed.

Results: No significant differences were found between the ptotic and non-ptotic eyes in terms of tear break-up time, Schirmer 1 test results, or meiboscores in cases of unilateral blepharoptosis. However, the non-ptotic upper eyelids showed a greater area of loss in the meibomian glands compared to the ptotic eyelids.

Conclusion: In cases of unilateral blepharoptosis, while a reduction in dry eye parameters was observed bilaterally, an increase in the degree of ptosis was associated with a bilateral decrease in tear production. No significant difference was found between the ptotic and non-ptotic upper eyelids in terms of meiboscores. Blepharoptosis does not appear to cause significant alterations in the meibomian glands.

Keywords: Blepharoptosis; Dry Eye; Meibomian Gland Dysfunction.

INTRODUCTION

Dry eye is a multifactorial disease that arises from the disruption of tear film stability on the ocular surface, leading to symptoms such as burning, stinging, and redness. It develops as a result of decreased tear production or conditions that cause increased evaporation on the ocular surface. The condition becomes symptomatic with an increase in tear osmolarity and ocular surface inflammation. In advanced and prolonged cases of dry eye, destructive complications such as corneal vascularization, ulceration, perforation, and even vision loss may occur.

Age-related eyelid laxity and metaplasia at the meibomian gland orifices contribute to the increased incidence of blepharoptosis and dry eye in elderly patients (1). Therefore, dry eye is widely recognized as a significant public health issue in the geriatric population (2).

Studies have shown that in blepharoptosis, the atony and atrophy of the tarsal muscles surrounding the meibomian glands can cause a decrease in glandular secretion, potentially resulting in evaporative dry eye (3). Moesen et al., on the other hand, demonstrated that dry eye could be a contributing factor in the development of blepharoptosis (4). The increased orbital muscle tone caused by dry eye may lead to dehiscence and weakening of the levator aponeurosis at its attachment site, thereby contributing to the development of ptosis. Following ptosis surgery, dry eye symptoms may intensify as a result of the increased distance between the lower and upper eyelids (known as palpebral fissure distance [PFD]) and increased exposure of the ocular surface to ultraviolet effects due to inadequate eyelid closure (5).

The meibomian glands are responsible for the secretion of the lipid layer of the tear film, while the production of the aqueous layer is carried out by the lacrimal gland and accessory lacrimal glands. In eyelid operations performed with the conjunctival approach, if an incision is made on the tarsus, the meibomian glands located within the tarsus may be affected. Conjunctival operations that avoid the tarsus may have an effect on the accessory lacrimal glands of Wolfring and Krause, situated at the upper boundary of the tarsus and within the conjunctival fornix. This can lead to both aqueous-type and evaporative-type dry eye, associated with the increase in PFD. Therefore, in cases of ptosis, assessing dry eye and the status of the meibomian glands is crucial for planning the surgical approach and avoiding severe postoperative dry eye.

This study aimed to assess the meibomian glands in the ptotic and non-ptotic upper eyelids along with dry eye tests in unilateral blepharoptosis cases and explore the relationships between them.

METHODS

Patients presenting to the ophthalmology clinic of the tertiary hospital with unilateral blepharoptosis between June 2024 and August 2024 were included in the study after undergoing comprehensive ophthalmologic examinations. The data obtained from the ptotic and non-ptotic eyes of the cases were compared. Only patients without any other ocular pathology, who did not have a history of contact lens use, ocular trauma, or surgery were considered eligible. Informed written consent was obtained from all participants prior to their inclusion in the study.

The degree of ptosis in each case was evaluated using margin reflex distance (MRD), PFD, and levator function (LF) measurements. MRD was defined as the distance between the upper eyelid margin and the corneal light reflex. PFD was measured as the distance between the upper and lower eyelid margins. To measure LF, the patient was instructed to gaze downward as much as possible, and the position of the upper eyelid's lash edge was recorded on a ruler. Then, the patient was directed to gaze upward as much as possible. The distance covered by the lash edge on the ruler was measured and recorded as the LF measurement.

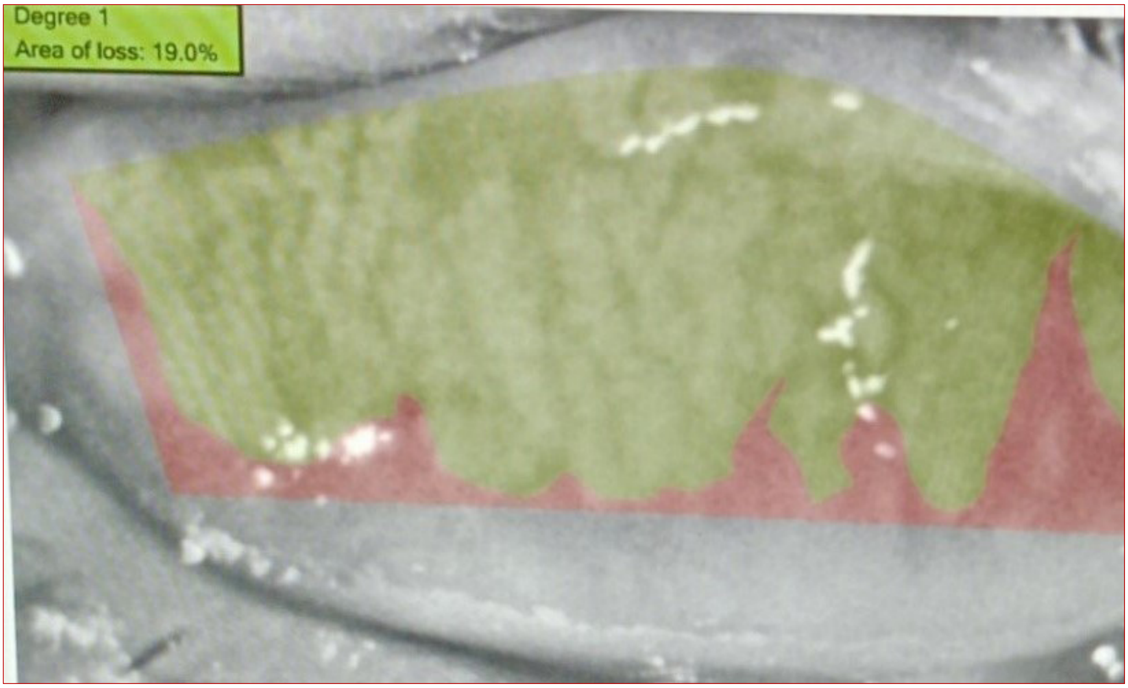
Dry eye symptoms were assessed using the Ocular Surface Disease Index (OSDI) questionnaire, a 12-question survey (6). The OSDI scores were categorized as follows: "normal" for scores between 0 and 12, "mild" for 13–22, "moderate" for 23–32, and "severe" for 33–100.

The evaluation of dry eye included the Schirmer 1 test and tear break-up time (TBUT) measurements. For the Schirmer 1 test, a specialized filter paper was placed in the lower eyelid's temporal conjunctiva, and the amount of tear production at 5 minutes was recorded as the Schirmer 1 value (7). For TBUT measurement, fluorescein paper was applied to the tarsal conjunctiva, and the corneal surface was examined under the blue light filter of a slit lamp. The time taken for the first corneal dry spot to appear after the patient blinked was recorded as the TBUT value (8). A Schirmer score below 5 mm and a TBUT below 10 seconds were considered indicative of dry eye.

To assess the meibomian glands, the upper eyelid was everted, and meibography was performed using the Sirius topography (CSO, Italy) to capture infrared images of the tarsal structure of the upper eyelid. Meibomian glands were marked manually on the images taken by the device. The ratio of the area of meibomian gland loss automatically detected by the device to the entire tarsal area (area of gland loss [AOL]), along with the meiboscore, were recorded (Figure 1). Meiboscores were categorized as follows: Grade 0 (no loss), Grade 1 (<25% loss), Grade 2 (25–50% loss), Grade 3 (50–75% loss), and Grade 4 (>75% loss) (9). Measurements were performed by the same specialist (Ş.S.) three times, and their averages were taken.

The study was conducted in accordance with the criteria of the Declaration of Helsinki after receiving approval from the Institutional Ethics Committee (date: June 6, 2024; decision number: 8/5).

Figure 1. Measurement of meibomian gland loss using the Sirius topography.



Statistical Analysis

The statistical analyses of the study findings were performed using SPSS 2027 software. Quantitative variables were presented as mean, standard deviation, median, minimum, and maximum values. The Shapiro-Wilk test and box plot graphs were used to assess the normality of the data distribution. For intra-group comparisons, the Wilcoxon signed-rank test was used for non-normally distributed variables, while the paired-samples t-test was employed for normally distributed variables. The relationships between variables were evaluated using Pearson's or Spearman's correlation analysis, depending on the distribution. Results were considered statistically significant at a 95% confidence interval, with a significance level of $p < 0.05$.

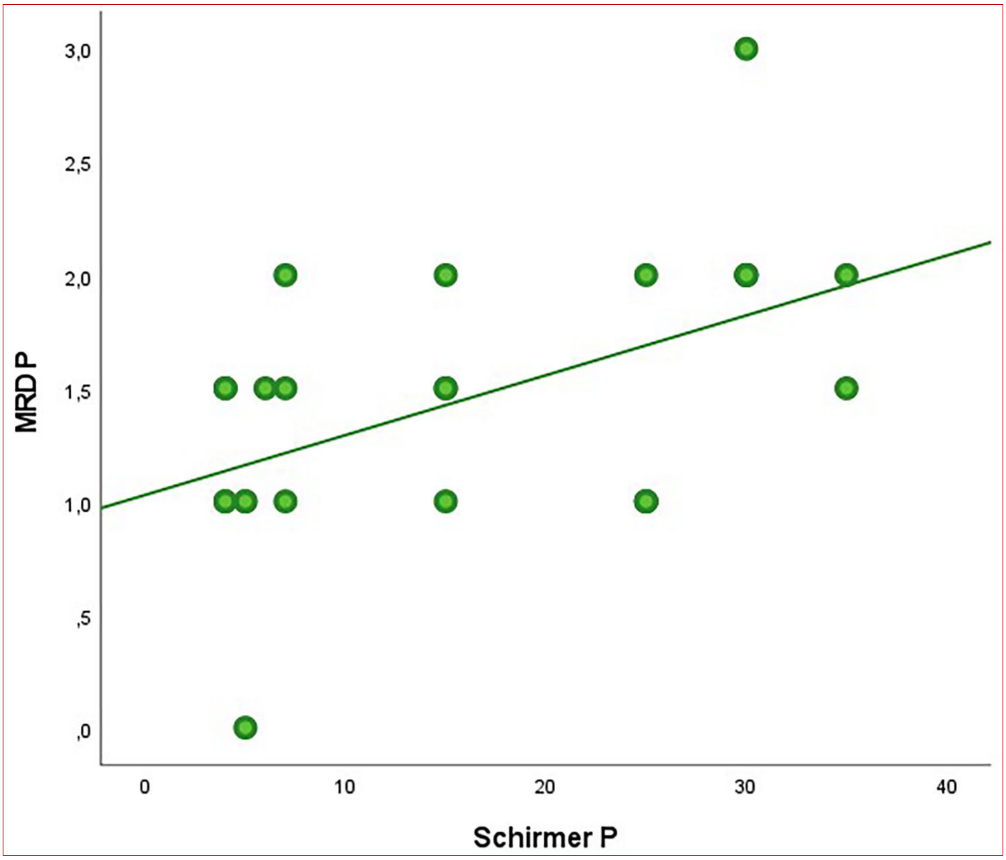
RESULTS

The study included 25 patients with unilateral blepharoptosis, consisting of 12 females and 13 males, with a mean age of 69 ± 10.6 years (range: 59–80 years).

The mean OSDI scores of the ptotic and non-ptotic eyes were 9.8 ± 3.2 and 9.8 ± 3.1, respectively. According to the OSDI scoring, 84% of the patients were classified as normal, while 16% were classified as having mild dry eye symptoms.

In 84% of both ptotic and non-ptotic eyes, the TBUT was less than 10 seconds. Schirmer test measurements were below 5 mm in 16% of the ptotic eyes and 8% of the non-ptotic eyes. There were no statistically significant differences between

Figure 2. Correlation between Schirmer test values and margin reflex distance in ptotic eyes



the ptotic and non-ptotic eyes in terms of TBUT or Schirmer 1 measurements (p>0.05).

Correlation analysis conducted between the degree of ptosis and parameters affecting the choice of surgical method, including MRD, PFD, and LF values, and dry eye parameters revealed a statistically significant positive correlation between BUT and LF in ptotic eyes (r=0.655, p=0.001; p<0.01). In contrast, no statistically significant relationship was found between BUT and PFD or MRD values in ptotic eyes (p>0.05). Similarly, no statistically significant correlations were observed between BUT and LF, PFD or MRD values in non-ptotic eyes (p>0.05).

No statistically significant correlation was found between Schirmer values and LF in ptotic eyes (p>0.05). However, there was a statistically significant positive correlation between Schirmer values and both PFD (r=0.667, p=0.001; p<0.01) and MRD (r=0.529; p=0.007; p<0.01) in ptotic eyes (Figure 2). No statistically significant correlations were detected between Schirmer values and PFD, MRD, or LF in non-ptotic eyes (p>0.05) (Table 1).

AOL measurements were significantly higher in non-ptotic eyes compared to ptotic eyes (p=0.001; p>0.01) (Table 2).

Table 1. Correlations of TBUT and Schirmer 1 Test Values with PFD, MRD, and LF

		TBUT, ptotic	**TBUT, non-ptotic**	**Schirmer, ptotic**	**Schirmer, non-ptotic**
PFD, ptotic	r	0.373	0.276	0.667	0.533
	p	0.066	0.182	0.001**	0.006**
PFD, non-ptotic	r	0.291	0.144	0.225	0.067
	p	0.157	0.492	0.281	0.750
MRD, ptotic	r	0.190	0.003	0.529	0.361
	p	0.363	0.988	0.007**	0.077
MRD, non-ptotic	r	0.494	0.032	0.481	0.305
	p	0.012*	0.878	0.015*	0.138
LF, ptotic	r	0.655	0.486	0.324	0.190
	p	0.001**	0.014*	0.114	0.363
LF, non-ptotic	r	0.316	0.321	0.118	0.058
	p	0.124	0.118	0.575	0.784

r: Spearman's correlation test, *p<0.05, **p<0.01
LF: levator function; MRD, margin reflex distance; PFD, palpebral fissure distance; TBUT, tear break-up time

Table 2. Comparison of AOL Values

			Change Δ	**p**
AOL, ptotic	Mean ± SD	11.80 ± 7.97	5.22 ± 4.62	0.001**
	Median (min–max)	9.7 (1.6–37.6)		
AOL, non-ptotic	Mean ± SD	17.02 ± 10.49		
	Median (min–max)	14.8 (3.7–57.3)		

Wilcoxon signed-rank test, **p < 0.01
AOL: area of gland loss; SD: standard deviation

Table 3. Meiboscores of the ptotic and non-ptotic eyes

Group	Grade 0 (No loss)	Grade 1 (<25% loss)	Grade 2 (25–50% loss)	Grade 3 (50–75% loss)	Grade 4 (>75% loss)
Ptotic eyes (n)	11	12	2	0	0
Non-ptotic eyes (n)	9	13	2	1	0

No statistically significant difference was found between the meiboscores of the ptotic and non-ptotic eyes ($p=0.87$; $p>0.01$) (Table 3).

DISCUSSION

Dry eye and blepharoptosis are prevalent, especially in the elderly population, and can lead to severe complications, including vision loss, if left untreated (10). When blepharoptosis is accompanied by dry eye, the potential for increased dry eye symptoms is increased, particularly due to the possibility of inadequate eyelid closure and increased PFD following ptosis surgery.

In our study, we did not detect significant dry eye symptoms in the ptotic eyes based on the OSDI questionnaire, and the Schirmer test results were consistent with this finding, showing normal values. However, TBUT values were below normal in 84% of the cases.

One of the main findings of our study is that while there was a decrease in TBUT in blepharoptosis cases, no significant reduction was observed in Schirmer 1 test results. In the current study, a decrease in Schirmer 1 values was only observed in cases where MRD and PFD values were significantly reduced. This suggests that in cases of ptosis, there is primarily an evaporative type of dry eye, and when MRD and PFD are severely reduced, aqueous tear production also decreases (4). Similarly, Moosen et al. reported a decrease in both TBUT and Schirmer tests in blepharoptosis cases, suggesting that dry eye can lead to weakening and separation of the levator aponeurosis. However, Dailey and Uğurbaş et al. found no effect of conjunctival Müller muscle resection surgery on tear parameters or meibomian gland dysfunction values in blepharoptosis cases (11,12).

In our study, the lack of significant differences in meiboscores between ptotic and non-ptotic eyes suggests that ptosis does not directly affect the meibomian glands, and that evaporation may be associated with a reduction in the blink reflex. The lack of significant differences in dry eye test scores between ptotic and non-ptotic eyes indicates that dry eye tests are symmetrically affected in unilateral blepharoptosis. This may also be related to the bilateral nature of the blink reflex.

In our cases, there was a positive correlation between TBUT and LF in ptotic eyes, whereas no significant correlation was found between Schirmer 1 and LF. The positive correlation between Schirmer 1 and PFD and MRD indicates that as ptosis severity increases and PFD and MRD decrease, aqueous tear production also decreases. The extensive coverage of the ocular surface by the eyelid may reflexively reduce tear production. We found no correlation between TBUT values and LF among non-ptotic eyes.

According to our study, the higher AOL values observed in non-ptotic eyes compared to ptotic eyes do not directly support the idea that blepharoptosis causes atrophy in the meibomian glands. However, the presence of ptosis, even if unilateral, may lead to a decrease in neurosecretory reflex stimulation, subsequently reducing the need for tear production. This reduction could indirectly result in atrophy of the meibomian glands in both ptotic and non-ptotic eyelids. The higher meiboscore results in our study, compared to other studies, may be related to the fact that the mean age of our patients fell within the middle and older age groups (13).

Further studies involving a larger number of cases are needed to evaluate ocular surface and dry eye parameters related to the degree and frequency of eyelid opening and closure associated with blepharoptosis. In cases of bilateral ptosis, incorporating assessments of dry eye tests and meibography parameters could provide more informative results. Another limitation of our study is the lack of a healthy control group of similar age. Comparing the meibomian gland status of non-ptotic individuals in the same age group could provide more objective results.

CONCLUSION

Dry eye and blepharoptosis are particularly prevalent in the geriatric population. While aqueous-deficient dry eye may occur at an advanced age, the presence of blepharoptosis may also lead to the development of evaporative dry eye. According to our results, the meiboscores of eyelids with blepharoptosis did not significantly differ from those of non-ptotic eyelids. However, consistent with the degree of ptosis, there was a decrease in the TBUT and Schirmer test parameters. Following ptosis surgery, an increase in eyelid aperture may lead to an exacerbation of dry eye symptoms, a factor that should be considered during surgical planning. Furthermore, the preoperative evaluation of the meibomian glands through meibography is crucial for detecting potential meibomian gland dysfunction.

Conflict of Interest: The authors state that the study was conducted without any commercial or financial relationships that could be seen as a potential conflict of interest.

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