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Effects of Botulinum Toxin a Treatment on Ocular Surface in Patients with Entropion

Entropiyonlu Hastalarda Botulinum Toksin A Tedavisinin Oküler Yüzey Üzerindeki Etkileri

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ABSTRACT

OBJECTIVE: This study aims to investigate the effects of Botulinum toxin A (BTA) and surgical intervention on the ocular surface in patients with entropion.

MATERIALS and METHODS: This is a prospective case-control study. The patients who have entropion (senile and spastic) are treated with BTA or surgical operation (Jones Procedure). Tear break up time (TBUT), ocular surface disease index (OSDI) score, Schirmer I test, and Oxford scale were analyzed at the outset and one and three months after the procedure.

RESULTS: Fifty patients (23 males, 27 females; mean age 65.04 ± 6.97 years) participated in the study. Significant improvements were observed in TBUT, OSDI, Schirmer I, and Oxford scores after both BTA and surgery. No difference was found in TBUT between the first and third month. OSDI scores were significantly lower in the group at both time points (p=0.039, p=0.049). Schirmer I was higher in the surgery group at the third month (p=0.040), while the BTA group had lower Oxford scores at the first month (p=0.037), with no difference at the third month.

CONCLUSION: BTA application is an effective and safe method to improve ocular surface parameters in the treatment of entropion. The fact that some of these effects are superior to the surgical method may cause BTA application to be preferred in patients with ocular surface disorders.

KEYWORDS: Anterior segment, botulinum toxin A, entropion, eyelid

ÖZ

AMAÇ: Bu çalışmanın amacı entropiyonlu hastalarda Botulinum toksin A (BTA) ve cerrahi müdahalenin oküler yüzey üzerindeki etkilerini araştırmaktır.

GEREÇ ve YÖNTEM: Çalışma prospektif ve vaka-kontrol tipindedir. BTA ve cerrahi (Jones Prosedürü) uygulanan entropionlu (senil ve spastik) hastalarda gözyaşı kırılma zamanı (TBUT), oküler yüzey hastalık indeksi (OSDI) skoru, Schirmer I testi, Oxford skalası başlangıçta ve işlemden bir ve üç ay sonra analiz edildi.

BULGULAR: Elli hasta (23 erkek, 27 kadın; ortalama yaş 65,04±6,97 yıl) çalışmaya dahil edildi. Hem BTA hem de cerrahi sonrasında TBUT, OSDI, Schirmer I ve Oxford skalasında anlamlı iyileşmeler gözlendi. TBUT'de birinci ve üçüncü aylar arasında fark bulunmadı. OSDI skorları her iki zaman diliminde de BTA grubunda anlamlı olarak daha düşüktü (p=0,039, p=0,049). Schirmer I üçüncü ayda cerrahi grupta daha yüksekken (p=0,040), BTA grubunun Oxford skorları birinci ayda daha düşüktü (p=0,37), üçüncü ayda ise fark yoktu.

SONUÇ: BTA uygulaması entropiyon tedavisinde oküler yüzey parametrelerini iyileştirmek için etkili ve güvenli bir yöntemdir. Bu etkilerin bazılarının cerrahi yönteme göre daha üstün olması oküler yüzey bozukluğu olan hastalarda BTA uygulamasının tercih edilmesine neden olabilir.

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INTRODUCTION

Entropion is a frequent eyelid disorder where the eyelid margin turns inward. It can be classified into four types: congenital, spastic, involutional, and cicatricial (1). Involutional (senile) entropion is the most prevalent form encountered in general ophthalmic practice, with its incidence increasing progressively with advancing age. The cause of involutional entropion is multifactorial and is thought to result from age-related degenerative changes. These changes include horizontal and vertical laxity of the lower eyelid, lower lid retractors disinsertion, the preseptal orbicularis oculi muscle overriding the pretarsal portion, enophthalmos, and structural degeneration of the tarsal plate (2-4). Spastic entropion is a sudden-onset condition caused by excessive contraction of the orbicularis muscle, usually triggered by irritation or inflammation of the eye (2).

Most patients with entropion experience eye irritation, foreign-body sensation, tearing, redness, burning, light sensitivity, and blurred vision. The inturned eyelid can cause corneal damage, potentially leading to vision loss (5,7).

Entropion can be treated with surgical and medical methods. Surgical methods have been defined depending on the factors in the development of entropion. These are operations performed on the lower lid (e.g., Jones procedure) such as corrections of horizontal laxity through lower lid shortening, transverse blepharotomy (Wies Procedure), and operations on the orbicularis oculi muscle (e.g.Pretarsal orbicularis oculi muscle tightening) (6). Medical methods can be listed as the use of lubricant tears, lid taping, and botulinum toxin injection (2). Medical treatment is useful as a temporary method in patients awaiting surgery or in patients who cannot undergo surgical correction due to systemic comorbidity (7,8).

Botulinum toxin is a exotoxin produced by Clostridium botulinum, a gram-positive, spore-forming anaerobic bacterium. It is regarded as the most potent biological toxin known (9). Since its initial clinical trials for treating strabismus in the 1970s, the application of botulinum toxin has broadened significantly (10).

The TFOS DEWS II Iatrogenic Dry Eye Subcommittee states that dry eye disease can be caused by a range of medical interventions, including the use of topical or systemic medications, contact lenses, eye surgeries, and certain non-surgical treatments (11,12). Eyelid surgery is commonly linked to the onset of dry eye disease or the worsening of existing dry eye symptoms. Yet, it is often overlooked or underrecognized (13).

In TFOS II, it is stated that many different methods can be used in the diagnosis of dry eye. Ocular surface disease index (OSDI) and 5-item dry eye questionnaire is used to determine symptoms. Tear break-up time (TBUT) and non-invasive TBUT is applied for tear film stability and osmometer is employed for osmolarity. Fluorescein and lissamine green stain for ocular surface staining are recommended (14). In addition, it has been stated that the more tests are used together for the diagnosis of dry eye, the more accurate the diagnosis is (15).

This study aims to evaluate the outcomes of the treatment in patients managed with surgical techniques and Botulinum toxin A (BTA), while assessing the impact of both approaches on dry eye symptoms.

MATERIALS & METHODS

This is a prospective case-control study conducted in 2022.
The study followed the principles outlined in the Declaration of Helsinki and received approval from the ethics committee Kartal Lütfi Kırdar City Hospital (28.01.2022-2022/514/218/11). Patients were informed about the potential risks and benefits of the procedure. Written informed consent was obtained, including permission to use identifiable p hotographs for publication.

The study included patients with senile and spastic entropion who had not undergone any previous surgical or medical procedure. Patients with a history of eyelid or ocular surface surgery (e.g., keratoplasty, pterygium excision), those presenting with severe corneal or conjunctival pathology (e.g., descemetocele, scarring of the bulbar or palpebral conjunctiva), individuals diagnosed with comorbid conditions that may directly compromise the ocular surface - such as mucous membrane pemphigoid, ocular rosacea, and Stevens-Johnson syndrome - as well as those receiving medical therapy for ocular surface disease other than artificial tear drops or lubricating gels, were excluded from the study. These treatments were applied equally in both groups.

The patients' demographics information, clinical history, visual acuity, previous surgery, duration of follow-up, and complications were all noted.

Botulinum Toxin Application

Topical lignocaine gel was applied to each patient 15 minutes before the procedure. (Image 1) BTA 100 U (BOTOX®, Allergan Corporation, Irvine, CA, USA) diluted with 2 mL of sterile saline in order to achieve a concentration of 5 units per 0.1 mL. The injection was administered subcutaneously using a 30-gauge needle at the junction between the pretarsal and preseptal portions of the orbicularis oculi muscle, approximately 4 mm below the lash line of the lower eyelid, at six designated points along the eyelid (from medial border punctum level to lateral border lateral canthus level). The application time of the procedure lasted an average of 5 minutes (Image 2). Patients were prescribed a combination of antibiotic-steroid eye drops and antibiotic ointment to use for ten days after the procedure. Patients were examined in the first week, first month, and third month after the procedure. Patients were followed up forcosmetic and functional results, and possible complications.

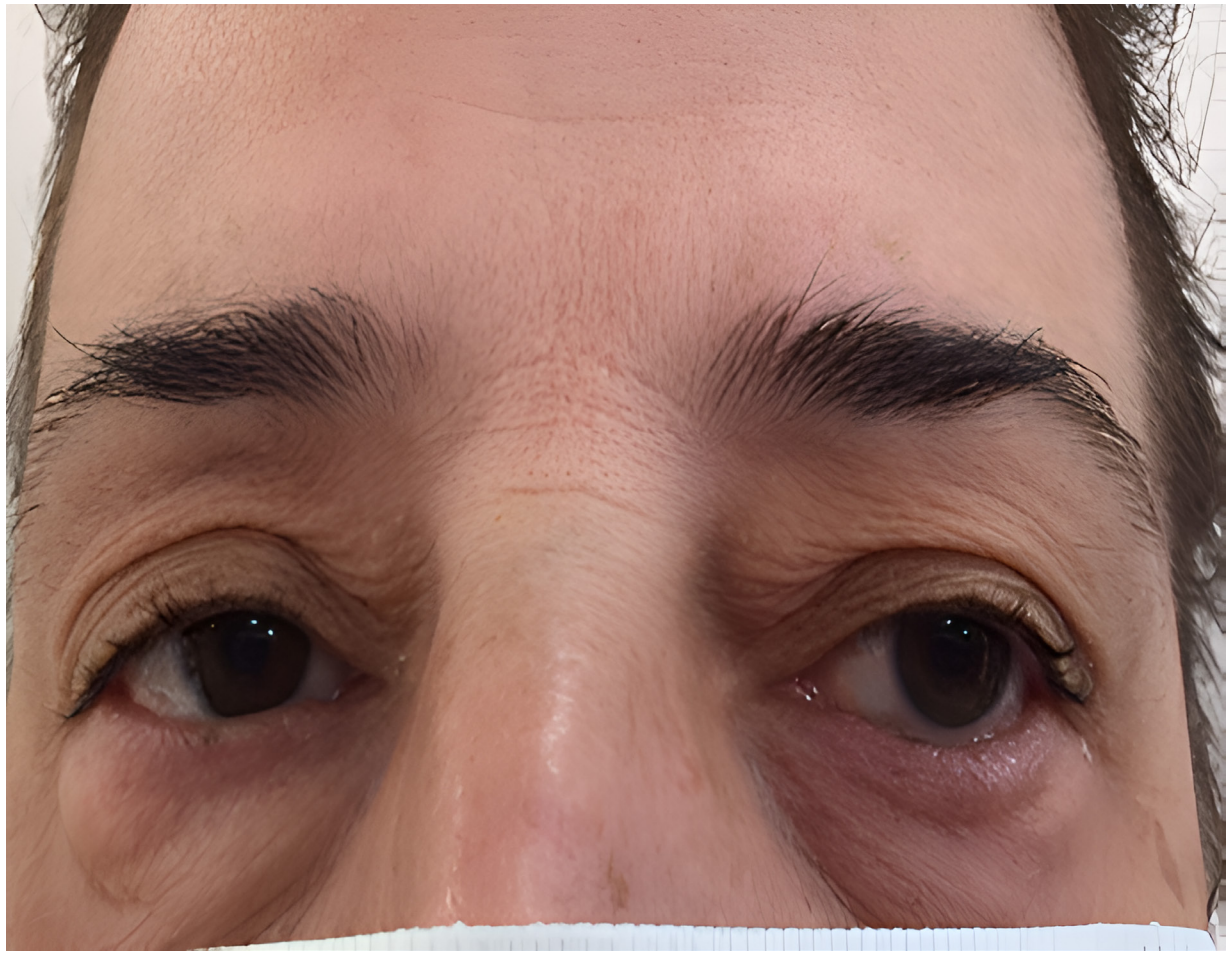

Image 1. *Sixty years old involutional entropion patient who had not undergone previous entropion surgery*

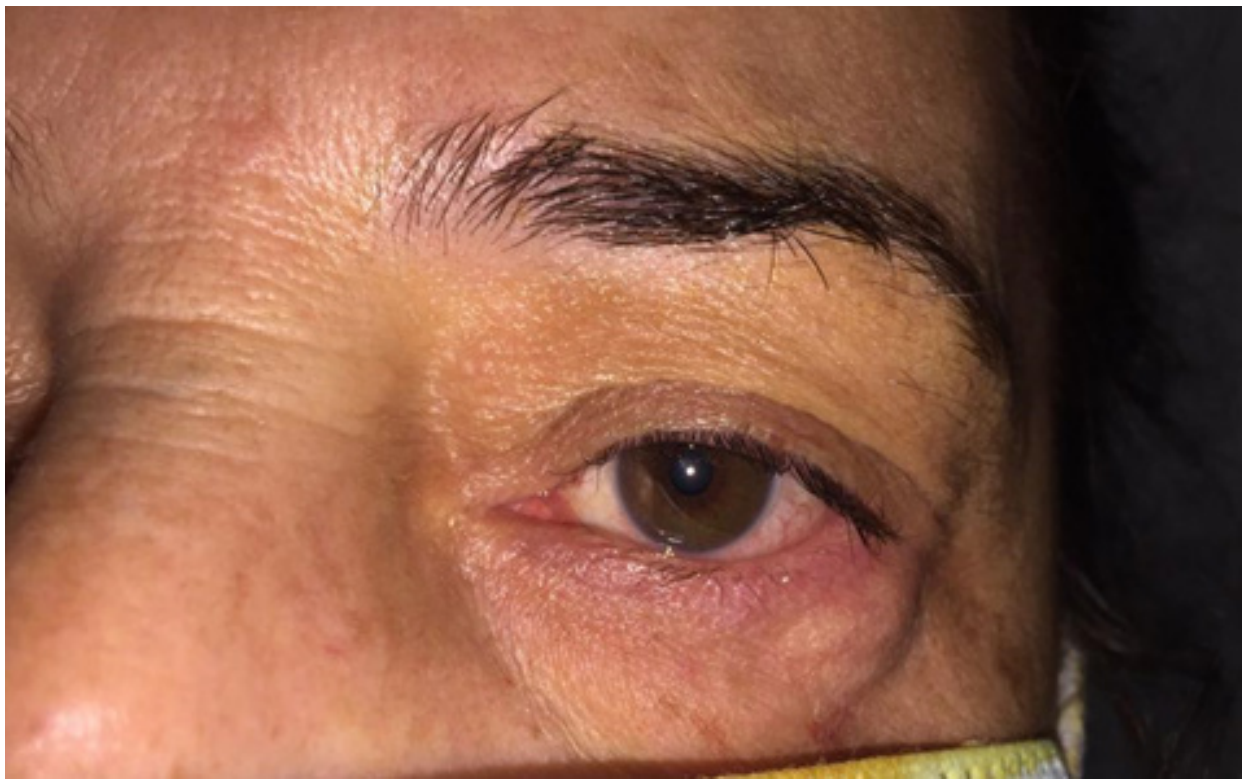

Image 2. *Partial improvement in lower lid contour after BTA application*

Surgical Procedure

The surgeries were performed by experienced surgeons (MO and TY). Local anesthesia was then achieved by subcutaneously injecting a mixture of 0.5% bupivacaine, 1% lidocaine hydrochloride, and 1:100,000 epinephrine into the lower eyelid to aid in hemostasis. This anesthesia was applied rather superficially to avoid interfering with the function of the lower eyelid retractors.

A surgical incision was created 4 mm beneath the eyelashes, stretching from the punctum to the lateral canthus. The pretarsal and preseptal muscles were separated to reveal the lower edge of the tarsal plate. A small portion of the pretarsal orbicularis muscle was resected. Following this, the preseptal muscle was dissected, and the lower orbital septum was divided. The orbital fat located in front of the lower retractors was retracted. The retractor aponeurosis was identified by grasping it with forceps and having the patient look downwards and then upwards. Proper involvement of the retractor system was confirmed by feeling the traction during downward gaze and relaxation during upward gaze (16). Three 6-0 Vicryl sutures were used to connect the lower margin of the tarsal plate to the upper segment of the lower eyelid retractor muscle, positioned about 8.0 mm beneath the tarsus. These sutures were positioned along a plane passing through the tarsal plate, covering the lateral two-thirds of the eyelid. The excess of the skin was excised horizontally as it is needed. The skin incision was closed with continuous 6-0 coated Vicryl sutures. Patients were prescribed a combination of antibiotic-steroid eye drops and antibiotic ointment to use for ten days after the postoperative period. Patients were examined in the first week, first month, and third month after the operation.

Patients who underwent surgery, and treated with BTA were followed up one week, one month, and three months after the procedure. Corneal staining (Oxford scheme), TBUT, Schirmer I test, and OSDI scoring were applied in the specified order prior to the BTA procedure or surgery, and at one and three months

following the treatment. The results were compared across pre- and post-procedural periods, as well as among various post-treatment intervals.

After BTA and surgical procedures, patients were not given any treatment for dry eye other than artificial tears and lubricating gel. Patients requiring additional treatment were excluded from the study. These treatments were applied equally in both groups.

Statistical Analysis

IBM SPSS version (IBM Corp., Armonk, NY, USA) 27 was used and $p<0.05$ was considered statistically significant. The Kolmogorov-Smirnov test was used to assess the normality of distribution for continuous variables. Variables such as age, TBUT at the first and third month, and Schirmer test at the first and third month were found to follow a normal distribution. Other variables did not meet the assumption of normality. Quantitative data were expressed as mean ± standard deviation for normally distributed variables and as median (interquartile range) for non-normally distributed variables. Categorical variables were presented as numbers and percentages. Both parametric and non-parametric tests were used depending on data distribution. Paired samples t-tests were applied for normally distributed paired variables. For non-normally distributed related variables, the Wilcoxon signed-rank test was used. Repeated measures comparisons across three time points were analyzed using the Friedman test. Given the exploratory nature of the study, post-hoc pairwise comparisons were conducted without Bonferroni correction. For comparisons between the two independent groups (BTA vs. surgery), the Mann-Whitney U test was used.

RESULTS

Demographic Findings

The 50 patients included in the study, 23 (46%) were male and 27 (54%) were female. The mean age of the patients was 62.6±8.15 (40-83) years. The mean age of the patients who underwent BTA treatment was 59.7±8.6 (40-77), and the mean age of the patients who underwent surgical procedure was 65.0±7.0 (51-83). There is no statistically significant difference between the age and gender of the patients who underwent BTA or surgical procedure ($p>0.05$).

At the first and third month follow-up visits, no recurrence of entropion was observed in patients who underwent surgery, and no adnexal structures were in contact with the ocular surface. Similarly, all patients who received BTA benefited from the procedure, with no recurrence of entropion and no adnexal contact with the ocular surface at the first and third month follow-ups. However, two patients required an additional BTA injection one week later due to an insufficient initial effect, and one patient experienced temporary facial paralysis. Improvement in entropion was observed after the additional BTA injection. In the patient who experienced facial paralysis, the condition completely resolved one week later without any intervention.

No statistically significant differences were found in baseline corneal staining (Oxford scale), TBUT, Schirmer I test, and OSDI scores between patients scheduled for BTA injection and those scheduled for surgery ($p>0.05$).

TBUT

A statistically significant difference was identified in TBUT values between baseline and the third month following BTA administration ($p<0.001$). In contrast, the change in TBUT values between the first and third months post-BTA was not statistically significant ($p=0.106$) (Table 1).

Following the surgical intervention, TBUT values also demonstrated a statistically significant improvement compared to baseline ($p<0.001$). Nevertheless, no significant difference was detected between the first and third month postoperatively ($p=0.319$) (Table 1).

Moreover, when comparing the first and third month TBUT values in patients who underwent either BTA injection or surgical intervention, no statistically significant differences were observed ($p=0.357$ and $p=0.992$, respectively).

OSDI Score

There was a statistically significant difference in OSDI values before and at the third month following the BTA application ($p<0.001$). There was no statistically significant difference between OSDI scores at first and third month after the application ($p=0.27$) (Table 1).

Similarly, in patients who underwent surgical intervention,

a significant reduction in OSDI scores was observed when comparing preoperative and third-month postoperative values (p<0.001). Nevertheless, the change between the first and third postoperative months was not statistically significant (p=0.2) (Table 1).

Furthermore, a comparative analysis of the first a nd third month OSDI scores between the BTA and surgical groups revealed a statistically significant difference in favor of the BTA group (respectively p=0.039 and p=0.049).

Schirmer-I

Following BTA administration, a statistically significant elevation in Schirmer I values was noted at the third month compared to baseline (p<0.001). In contrast, the difference between the first and third month values did not reach statistical significance (p=0.218) (Table 1).

In the surgical group, Schirmer I values also demonstrated a statistically significant i mprovement w hen comparing preoperative and third-month postoperative measurements (p=0.034). Despite this, no significant difference was detected between the first a nd t hird p ostoperative m onths (p=0.218) (Table 1).

Additionally, comparative analysis of Schirmer I values between the BTA and surgical groups revealed a statistically significant difference in favor of the surgical procedure at the third month (p=0.040), whereas no such difference was observed at the first month (p=0.101).

Oxford Scale

Following BTA administration, Oxford Scale values demonstrated a statistically significant reduction at the third month compared to baseline (p<0.001), whereas the difference between the first and third months did not reach statistical significance (p=0.11) (Table 1).

Similarly, a significant reduction in Oxford Scale scores was observed after the surgical procedure compared to baseline values (p<0.001). Nonetheless, no significant difference was noted between the first and third postoperative months (p=0.59) (Table 1).

When comparing Oxford Scale scores between the BTA and surgical groups, statistical analysis revealed a significant difference in favor of BTA at the first month only (p=0.037), while no such difference was observed at the third month (p=0.101).

Comparisons of TBUT, OSDI, Schirmer-I, and Oxford scale parameters before treatment, at the first month, and at the third month in the BTA and surgery groups are summarized in Table 1.

Table 1. *Comparison of ocular surface parameters before and after treatment in BTA (n=23) and surgery (n=27) group*

		Before treatment		*1st month*		*3rd month*	
		Mean ± SD	*p[a]*	*Mean ± SD*	*p[b]*	*Mean ± SD*	*p[c]*
BTA	*TBUT*	*4.39±1.35*	*<0.001*	*11.61±2.86*	*0.106*	*12.57±2.84*	*<0.001*
	OSDI	*26.61±1.53*	*<0.001*	*12.52±5.87*	*0.027*	*11.09±5.17*	*<0.001*
	Schirmer	*5.65±1.15*	*<0.001*	*14.00±5.23*	*0.218*	*15.04±5.38*	*<0.001*
	Oxford	*2.96±0.82*	*<0.001*	*1.13±1.22*	*0.011*	*0.78±0.99*	*<0.001*

Table 1. Continued

Surgery	TBUT	4.22±1.74	<0.001	12.41±3.71	0.319	12.93±3.35	<0.001
	OSDI	27.15±3.99	<0.001	9.96±5.93	0.200	8.89±5.03	<0.001
	Schirmer	5.81±2.04	<0.001	17.41±7.42	0.218	19.11±7.12	0.034
	Oxford	3.07±0.87	<0.001	0.56±0.93	0.059	0.37±0.68	<0.001

BTA: Botulinum toxin A. p^a: Before treatment vs. 1st month after treatment comparison (BTA or surgery). p^b: 1st month vs. 3rd month after treatment comparison (BTA or surgery). p^c: Before treatment vs. 3rd month after treatment comparison (BTA or surgery). Statistical tests used: Paired samples t-test for normally distributed variables; Wilcoxon signed-rank test for non-normally distributed variables. Bonferroni correction was not applied to pairwise comparisons due to the exploratory nature of the study.

DISCUSSION

To the best of our knowledge, this study represents the first investigation into ocular surface parameters following the administration of botulinum toxin in patients diagnosed with entropion. This highlights the importance and originality of our research. We analyzed the effects of both BTA and the Jones procedure on the ocular surface and found significant improvements in parameters such as OSDI score, TBUT, Schirmer I test, and Oxford scale results before and after treatment. This underscores the efficacy of both treatment modalities in addressing the ocular surface complications associated with entropion.

Botulinum toxin is currently used for many different ophthalmological treatment options. These include blepharospasm, strabismus, chronic dry eye, aesthetic procedures and entropion (10).

It has been observed that botulinum toxin has been successfully used for different entropion situations in studies. Christiansen et al. (18) demonstrated the feasibility of botulinum toxin in congenital entropion; Ashena et al. (19) reported the use of botulinum toxin in upper lid entropion in children, Iozzo et al. (17) in senile lower lid entropion, and Neetens et al. in spasmodic lower lid entropion (17-20). Consistent with previous findings, the efficacy of botulinum toxin observed in the present study suggests that it may serve as a viable non-surgical alternative for the management of entropion.

Treatment with botulinum toxin requires repeated injections in various cosmetic and clinical settings. An important cause of secondary treatment failure is the immune response caused by the formation of neutralizing antibodies (21). Therefore, in the treatment of entropion with BTA, the transient nature of its therapeutic effect, combined with the potential induction of neutralizing antibodies, should be regarded as a limitation, as these factors may necessitate repeated administrations to maintain clinical efficacy.

Senile entropion is characterized by horizontal eyelid laxity, disinsertion of the lower eyelid retractors, and overriding of the orbicularis oculi muscle. Acute spastic entropion occurs after ocular irritation or inflammation, where sustained orbicularis oculi spasm overcomes the lower lid retractors, causing the eyelid to turn inward. Corneal irritation worsens the spasm, creating a cycle that usually requires intervention to break (22). Previous studies have shown successful results of using BTA in both groups of entropion (23,24). Despite all of these findings, the response of the two different groups to the treatment methods applied in the study might be different and this may change the results.

Jariyakosol et al. (25) examined the effects of botulinum toxin use in the treatment of benign haemifacial spasm (BEB) on ocular surface and dry eye disease for three months. It was reported that one month and three months after BTA injection, TBUT, OSDI score, Schirmer test and Oxford scheme grade were not significantly changed in the affected eyes compared to the outset (25). Sanguandikul et al. (26) reported that ocular surface parameters did not change before and after the procedure in a study in which botulinum toxin was used in BEB patients and related complications were investigated. Serna-Ojeda and

Nava-Castaneda reported that botulinum toxin administered to dry eye patients caused regression in dry eye symptoms (increase in TBUT and Schirmer's and decrease in corneal staining) at the end of the third month (27). Similar to other studies, ocular surface parameters did not change significantly at the end of the first and third month in this study; significant changes were observed in ocular surface parameters before and after the procedure. This may be attributed to the more pronounced negative effect of entropion on the ocular surface compared to BEB. We hypothesize that the absence of long-term disturbance in ocular surface parameters following BTA injections stems from the paralysis of the orbicularis muscle post-procedure. Consequently, this disruption affects the function of the lacrimal pump, resulting in an extended retention of tears on the ocular surface (28).

Previous studies have reported the use of BTA in dry eye patients by affecting the orbicularis oculi and Horner muscle, decreasing the lacrimal pump and lacrimal drainage system by reducing blink volume (24,29). It is conceivable that this may cause epiphora, leading to adverse effects of tearing on the ocular surface. However, there are also studies showing that BTA has been successfully used in crocodile tear syndromes causing significant epiphora (30,31). It was reported that BTA caused chemodenervation of cholinergic neurons in the lacrimal gland and decreased the amount of tears (23). In this study, it was thought that the lacrimal pump was significantly affected due to the direct application of BTA to the orbicular muscle and that the ocular surface parameters improved and no significant side effects were observed due to the relatively low effect on the lacrimal gland by diffusion (23,30,31).

Surgical treatment is the most preferred treatment method, but there is still no golden standard technique today. Many surgical techniques have been proposed with an achievement of 50-80% successful healing (20).

Lee et al. (32) examined 20 patients who underwent upper lid entropion correction surgery using a modified Quickert's procedure. The study found that there was a significant improvement in dry eye symptoms after surgery as measured by Schirmer's test & tear film breakup time (32). In an attempt to determine the effect of entropion surgery on corneal health; including surface epithelium, change in corneal curvature, tear film stability and vision, Monga et al. reported a positive effect of the surgery (33). In the study, significant improvement was observed in ocular surface parameters before and after surgery, but no statistical difference was found between the values at first and third month. We think that the fact that entropion surgery does not cause long-term deterioration in ocular surface parameters is due to the excision of the orbicular muscle in the procedure, which, by a mechanism similar to that considered in BTA, causes impairment in the function of the lacrimal pump, leading to longer retention of tears on the ocular surface.

Ceylan et al. (34) attributed the ocular surface parameter changes in upper eyelid surgery in ptosis and dermatochalasis patients to the decrease in corneal sensitivity caused by proinflammatory cytokines and opioid peptides in the early period. Another study reported that dry eye symptoms were initially observed in patients undergoing upper eyelid surgery and resolved after weeks or months (35). Theoretically, disruption of the orbicularis oculi muscle during upper blepharoplasty may alter blinking, potentially leading to decreased mechanical distribution of the tear film and reduced lipid secretion from the meibomian glands (11,12). Similar results were observed in this study, and the positive difference in the BTA group in the Oxford scale at the first month after the procedures was not observed at the third month. This may be attributed to postoperative healing, tissue inflammation, reduced blink frequency, and anatomical alterations of the eyelid.

Schirmer tests are most useful in the diagnosis of patients with severe aqueous deficiency (36). BTA injection into the lacrimal gland reduces tear secretion by inhibiting the presynaptic release of acetylcholine at the neuromuscular junctions of cholinergic innervation (37). In the study, the higher Schirmer I test in patients who underwent surgery may be interpreted with the spread of BTA to the lacrimal gland and decreased tear secretion.

The OSDI (OSDI; Allergan, Inc, Irvine, California, holds the copyright), a PRO questionnaire, was designed to provide rapid assessment of the range of ocular surface symptoms related to chronic dry eye disease, their severity, and their effect on the patient's ability to function (Walt J OSDI Administration and Scoring Manual. Irvine, CA Allergan, Inc 2004). OSDI is designed to provide a more efficient, accurate, and reliable diagnosis of ocular surface disease, while also quantifying the

extent of visual impairment associated with dry eye disease (38). Various studies have shown a positive effect of botulinum toxin application on OSDI score in patients with BEB, hemifacial spasm, and dry eye disease (39,40). In this study, the superiority of BTA group both within itself and compared to the surgical group shows that botulinum toxin is more effective in the regression of ocular surface complaints in entropion patients.

The absence of additional dry eye treatments beyond the use of artificial tears and lubricating gel suggests that the observed changes in OSDI, TBUT, Schirmer I, and Oxford grading scales may primarily be attributed to the therapeutic effects of BTA administration or the surgical procedure itself. Nonetheless, the potential influence of minimal supportive therapies provided to patients cannot be entirely excluded, particularly with regard to their impact on certain parameters during the early postoperative period.

Limitations

This study has several notable limitations. The short follow-up period has limited the assessment of the long-term effects of repeated BTA injections on the ocular surface. The small sample size may reduce the statistical power and limit the generalizability of the results. Additionally, the study did not stratify or compare the outcomes of BTA treatment and surgical intervention across different subtypes of entropion, nor were comparisons made between various surgical techniques. All subgroups of the Schirmer test were not comprehensively evaluated, and the inherent variability of objective tests assessing the ocular surface, such as the Schirmer test, may affect the reliability of the findings. In addition, even minimal supportive treatment given to patients in the study may have had a small effect on the findings. The absence of double-blind masking represents another source of potential bias. Future research addressing these limitations is necessary to yield more robust and generalizable conclusions.

CONCLUSION

Some favorable effects of BTA injection in the treatment of entropion compared to surgery suggest that BTA injection might be a preferable alternative to surgical approaches, especially in cases with ocular surface disorder or dry eye disease. BTA offers a less invasive and effective option for improving ocular surface parameters and alleviating symptoms, particularly in cases where surgery is not feasible or preferred.

Ethics: The study followed the principles outlined in the Declaration of Helsinki and received approval from the ethics committee Kartal Lütfi Kırdar City Hospital (28.01.2022-2022/514/218/11).

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