

# Cosmetic blepharoplasty and dry eye disease: a review of the incidence, clinical manifestations, mechanisms and prevention

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## Abstract

• Dry eye disease is a multifactorial disease of the ocular surface and can be caused by a variety of iatrogenic interventions, especially ophthalmic surgical procedures. This article reviews the incidence, clinical manifestations, mechanisms and prevention of dry eye disease caused or worsened by cosmetic blepharoplasty, and focus on how to reduce and prevent the occurrence of postoperative dry eye disease and provide the basis for the selection of operation methods and the rational drug during the perioperative period.

• **KEYWORDS:** dry eye disease; cosmetic blepharoplasty; prevention

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## INTRODUCTION

Dry eye disease is a common disease of the ocular surface in clinical ophthalmology, and the incidence is increasing annually. In 2017, the Tear Film & Ocular Surface Society (TFOS) updated the definition of dry eye: dry eye is a multifactorial disease of the ocular surface characterized by a loss of homeostasis of the tear film, and accompanied by ocular symptoms, in which tear film instability and hyperosmolarity, ocular surface inflammation and damage, and neurosensory abnormalities play etiological roles<sup>[1]</sup>. The most common etiology of dry eye is the decreased production of

the lipid layer by meibomian glands, leading to destabilization and evaporation of the tear film<sup>[2]</sup>. The mechanism underlying the disease is tear hyperosmolarity caused by evaporation, and hyperosmotic tear can damage the ocular surface through two approaches: direct injury and the promotion of inflammation<sup>[3]</sup>. Therefore, dry eye disease can be divided into two primary categories, aqueous deficient and evaporative for the diagnosis and treatment<sup>[1]</sup>. Moderate-to-severe dry eye disease will be accompanied by obvious pain, persistent discomfort, and occasional blurred vision, leading to a decline in the quality of life, frequent visits to the doctor, and an increase in the anxiety regarding the illness; these phenomena, severely affect the physical and mental health of the patients<sup>[4-6]</sup>. The TFOS DEWS II Iatrogenic Dry Eye Subcommittee proposed that dry eye disease can be caused by various iatrogenic interventions, including topical or systemic drugs, the use of contact lenses, and ophthalmic surgical and non-surgical procedures. Among them, ophthalmic surgery mainly includes lid surgery, refractive surgery, keratoplasty, cataract surgery and other surgeries<sup>[7]</sup>.

In recent years, the rapid development of the economy and society has driven several individuals in pursuit of beauty; also, cosmetic blepharoplasty is widely carried out, and postoperative dry eyes are gaining increasing attention<sup>[7-8]</sup>. Previous studies demonstrated that some patients might experience the symptoms of dry eyes after cosmetic blepharoplasty. Further examination revealed ocular surface anomalies, such as corneal punctate epitheliopathy, shortened tear film breakup time (BUT), and increased osmotic pressure of tears<sup>[9-10]</sup>. However, the incidence of postoperative dry eye disease can be reduced if appropriate clinical interventions are given preoperatively, intraoperatively and postoperatively. Therefore, in order to improve the postoperative satisfaction and quality of life and avoid the occurrence or aggravation of dry eye disease, it is necessary to focus on and study the pathophysiology, mechanisms, treatment and prevention of dry eye disease after cosmetic blepharoplasty.

## INCIDENCE AND CLINICAL MANIFESTATIONS

Cosmetic blepharoplasty is known to cause postoperative dry eye disease or worsen the preoperative dry eye. The incidence of dry eye disease after cosmetic blepharoplasty is

**Table 1 Risk factors for dry eye disease following cosmetic blepharoplasty**

Anatomical	Environmental	Systemic	Medications
Negative vector orbit	Reduced humidity	Rheumatoid arthritis	Hormone replacement therapy
Negative lateral canthal tilt	Wind	Sjögren's syndrome	Diuretics
Scleral show	Allergens	Rosacea	Antihistamines
Lid laxity	Air condition	Amyloidosis	Anticholinergics
Lagophthalmos	Heating	Hemochromatosis	Antidepressants
Previous ophthalmic surgery	Drafts	Stevens-Johnson syndrome	Systemic retinoids

about 0-26.5%<sup>[10-11]</sup>. Prischmann *et al*<sup>[11]</sup> diagnosed dry eye disease in 26.5% of 892 patients following blepharoplasty in a retrospective study. Among them, simultaneous upper and lower blepharoplasty (31.3%) were more likely to cause dry eye disease, compared to simple upper blepharoplasty (12.9%) and simple lower blepharoplasty (21.4%). A study carried out in 60 patients with preoperative dry eye reported that the condition worsened in 5 (8%) patients while 50 (83%) showed no change<sup>[12]</sup>.

The clinical manifestations of patients with dry eye disease after cosmetic blepharoplasty are similar to those of patients with general dry eye disease. Typical symptoms include aggravating dryness, burning and a sandy or gritty sensation<sup>[11,13]</sup>. Other symptoms include pain, redness, tearing and photophobia<sup>[14]</sup>. Presently, the common examination methods include slit-lamp examination, tear meniscus height, BUT, corneal epithelial fluorescein staining and Schirmer's test. The examination findings of the postoperative dry eye disease patients differ dynamically<sup>[15-16]</sup>. Shao *et al*<sup>[16]</sup> demonstrated that 1wk after lower blepharoplasty, the Ocular Surface Disease Index (OSDI) score and the tear meniscus height values increased significantly while the Schirmer's test values decreased. In addition, all the indexes returned to baseline by 3mo, and even the indexes of some patients improved as compared to those before surgery. This phenomenon indicates that dry eye disease might occur or aggravate 1wk after cosmetic lower blepharoplasty, and the symptoms resolve within 3mo<sup>[16]</sup>. Another study showed that 95% of the patients with dry eye disease after cosmetic blepharoplasty recovered fully within 8wk<sup>[10]</sup>.

### RISK FACTORS

Dry eye disease is a multifactorial eye disease. Several risk factors account for the dry eye disease after cosmetic blepharoplasty. In the current study, these factors can be divided into sexual, anatomical, environmental, systemic and pharmacological (Table 1)<sup>[10-11,17]</sup>. Risk factors for dry eye disease are not absolute contraindications for blepharoplasty, however, once found, the decision to proceed must be made cautiously.

### MECHANISMS

Normal tearing depends on three components: production and

release of tears from the lacrimal gland and accessory glands, blinking and distribution of tears, and tear pumping into the lacrimal drainage system<sup>[18]</sup>.

Cosmetic blepharoplasty leading to dry eye disease might be attributed to the change of close interaction between the eyelids, tear film and ocular surface by surgery, which affects the effective lubrication of the tear film<sup>[13]</sup>. It can severely affect the position of the eyelid and the force of blink. Moreover, the resection of orbicularis oculi muscle would lead to the formation of scar and the injury to the innervation, which will result in incomplete reflex blink, decreased blink rate and lagophthalmos, thereby reducing the lipid secretion from the meibomian glands<sup>[10,19-20]</sup>. These phenomena might account for increased tear evaporation, decreased mechanical tear film distribution and reduced tear drainage with impaired debris removal from the ocular surface. Furthermore, dysfunctional eyelid closure caused by postoperative lagophthalmos, sclera show, ectropion, and dysfunction and/or dehiscence of the lateral canthus<sup>[21-22]</sup>, as well as increased corneal and conjunctival sensitivity induced by surgery<sup>[23]</sup> will all lead to the decline of the stability of tear film, causing postoperative dry eye disease, especially in poor Bell's phenomenon. Strikingly, elective cosmetic blepharoplasty may change the relative position of the eyelid and cornea, thus mechanically altering the corneoscleral and conjunctival interface to aggravate the dry eye disease<sup>[24]</sup>. Surgery might also influence the function of meibomian glands and lacrimal glands, resulting in postoperative dry eye disease<sup>[23]</sup>.

### PREVENTION MEASURES

The incidence of dry eye disease after cosmetic blepharoplasty is relatively high, which will affect the quality of life and the evaluation of the operation result. Therefore, the prevention measures by the surgeon are mainly carried out from the preoperative, intraoperative and postoperative aspects.

#### Preoperative Evaluation

**Patient history** Patients should be questioned in detail before the surgery in order to understand the presence of dry eye disease or risk factors. A preoperative assessment of exacerbating factors is crucial for predicting the incidence of postoperative dry eye disease. Firstly, ask the patient

if he or she had ophthalmic surgery recently, and if so, it is recommended to postpone the surgery for 6-12mo<sup>[10]</sup>. Clinicians should ask the patient whether he/she has a history of dry eye disease or symptoms. Because dry eye disease is a common but underdiagnosed disease, the clinicians can estimate if the patients have dry eye disease by asking them about the typical symptoms. Also, it is necessary to identify the existent habits that might aggravate the postoperative dry eye disease. Prolonged reading<sup>[25]</sup>, computer usage, driving, and watching television<sup>[13]</sup> can reduce the rate of blinking and exacerbate dry eye disease. The history of smoking should also be considered. A study carried out between 51 smokers and 50 healthy non-smokers showed that smoking causes adverse effects on the tear film and had intense correction with tear film instability<sup>[26]</sup>. In addition, clinicians should take into account the history of the patient to confirm the existence of risk factors of postoperative dry eye disease, such as environmental factors, systemic disease, and medication. What's more, the difficulty in wearing contact lenses cannot be ignored because this might be related to inadequate tear production<sup>[13]</sup>.

**Physical examination** Physical examination should be performed before surgery in order to examine whether the patient has anatomical risk factors. The Schirmer's test can also be performed before surgery, however, it is advised to use a topical corneal anesthetic to reduce the secretion of reflex tearing caused by corneal or sclera irritation<sup>[13]</sup>.

In the case of patients with dry eye previously and with postoperative risk factors of dry eye, clinicians should fully communicate with patients before cosmetic blepharoplasty, and make a cautious decision. Moreover, a preoperative intravenous dose of dexamethasone might limit the inflammatory response<sup>[27]</sup>.

**Surgical technique** It is suggested to pay attention to the following points during cosmetic blepharoplasty. 1) Corneal protection is essential during surgery. Trauma and excessive or prolonged exposure can all lead to corneal abrasion or ulceration, which is one of the major causes of postoperative dry eye. Therefore, lubrication or corneal shields should be used during the operation<sup>[28]</sup>.

2) A surgeon should evaluate the scope of the operation measure precisely. While performing an upper cosmetic blepharoplasty, it is essential to measure accurately with a caliper and leave 8 to 9 mm in the pretarsal fold and at least 20 mm of upper eyelid skin must be retained when measuring centrally from the lower margin of the brow to the lid margin<sup>[8]</sup>. Also, postoperative lagophthalmos should not exist in most cases and should be less than 2 mm even in the presence of edema<sup>[10]</sup>. While performing lower blepharoplasty, skin resection should be conservative, because postoperative healing and scarring may lead to lower lid retraction and ectropion.

3) The selection of operation methods should be prudent. It was figured that the incidence of dry eye disease following skin-muscle flap blepharoplasty (29.0%) was higher than that of transconjunctival approach (25.6%) and transconjunctival approach with skin pinch (22.9%)<sup>[11]</sup>.

4) The orbicularis oculi muscle and innervation should be protected as damage might decrease the blink rate and cause evaporative tear loss. A limitation to this suggestion is in the Asian eyelid: in order to facilitate a natural, flattening contour of the newly formed upper eyelid crease and prevent postoperative lagophthalmos, a maximum of 1-2 mm cuff of orbicularis oculi muscle along the incision could be trimmed<sup>[8]</sup>.

5) The inflammation should be controlled by minimizing the trauma. A previous study showed that control of inflammation could lessen the likelihood of chemosis<sup>[29]</sup>, which is a common and mostly self-healing complication of cosmetic blepharoplasty. After the surgery, fluid would accumulate in the eyelid and subconjunctival space due to the disruption of lymphatics and venous congestion caused by postoperative scar<sup>[30]</sup>. Chemosis is closely related to dry eye disease, because severe and persistent chemosis may destroy the goblet cells, thereby resulting in unstable tear film that begins the vicious cycle of dry eye<sup>[10]</sup>. It is well known that a preoperative intravenous dose of dexamethasone limits the inflammatory response<sup>[30]</sup>. Furthermore, the upper and lower cosmetic blepharoplasty should be carried out separately to reduce the incidence of postoperative dry eye disease and chemosis<sup>[11]</sup>.

6) Canthopexy can be performed to correct the lateral canthal depression and prevent ectropion. Transcutaneous lower blepharoplasty with canthal support and orbicularis resuspension provides safe and effective rejuvenation of the lower eyelid<sup>[31]</sup>.

7) Care should be taken to protect the lacrimal gland. It is essential to have a thorough understanding of the eyelid anatomy and not mistake a prolapsed lacrimal gland for fat<sup>[32-33]</sup>. Massry<sup>[33]</sup> found that about 60% of patients undergoing blepharoplasty had some degree of lacrimal gland prolapse, especially in those with multiple previous eyelid surgeries. If the lacrimal gland is prolapsed, it is proposed to resuspend the lacrimal gland to the periosteum along the inner aspect of the superolateral orbital rim<sup>[8]</sup>.

**Postoperative Prevention** The purpose of postoperative prevention of dry eye disease is to limit edema, hydration and lubrication, control inflammation and prevent infection<sup>[10,34]</sup>. Postoperative edema can be controlled by elevating the head and applying a cold compress around the orbit<sup>[10]</sup>. To protect against the inflammatory response and conjunctivitis, topical antibiotic and steroid drops should be applied<sup>[7]</sup>. The frequency and duration of the use depend on the severity of ocular surface inflammation in patients. A large number of animal studies

have proved that the use of steroid can break the vicious cycle of dry eye immune response. Steroids act to stabilize the cell membranes and suppress the inflammatory reaction<sup>[35]</sup>. And it is suggested to use artificial tears during the day and lubrication at night on their own terms<sup>[13,36]</sup>.

When symptoms last for longer than 2wk after blepharoplasty, it is essential to examine the patients to find out the possible cause and alter the management.

Nonetheless, the presence of chemosis must be concerned. If chemosis is fortunately not present, lubrication and typical corticosteroids should be continued. If symptoms persist for longer than 3mo, tear duct occlusion can be considered to maintain ocular lubrication<sup>[23]</sup>. Overzealous resection of upper or lower lid skin could also be taken into account if the exposure symptoms do not respond to conservative treatment, necessitating a skin graft<sup>[37]</sup>. If symptoms continue to persist or worsen, they may be associated with postoperative lid malposition and may require canthopexy/plasty or lower eyelid repositioning including firm canthal tendon anchoring and lateral canthal reconstruction<sup>[4,7]</sup>. Unfortunately, if chemosis persists, this should be addressed aggressively. Persistent chemosis can be treated as well as edema and additional eye patching is needed<sup>[38]</sup>. It is imperative that eye patching is performed appropriately and the duration depends on the severity of chemosis. The prescription of steroid eye drops, topical phenylephrine, and a tapering dose of systemic corticosteroids should be administered equally<sup>[21,36,38]</sup>. Topical cyclosporin A 0.05% two times per day and a temporary suture tarsorrhaphy should be considered when necessary<sup>[10]</sup>.

## CONCLUSION

The incidence of dry eye disease after cosmetic blepharoplasty is increasing gradually, and dry eye has a great influence on the quality of life of the patients. Currently, only a few studies have reported the dry eye disease after cosmetic blepharoplasty, and the examination methods are limited to Schirmer's test and BUT. It is suggested to use the recent examination methods, involving lipid layer thickness, to deduce whether the patients have meibomian gland dysfunction, as well as the etiology of postoperative dry eye disease. It is also recommended to evaluate the spontaneous eye blink patterns of patients and estimate their correlations with the postoperative dry eye disease. Thus, it is necessary to focus on how to reduce and prevent the occurrence of postoperative dry eye disease, and provide the basis for the selection of operation methods and the rational drug use during perioperative period. It is beneficial for postoperative patients to protect the ocular surface and reduce the incidence of postoperative dry eye disease, thereby improving the quality of life of the patients. Furthermore, it is essential for the surgeon to recognize and address the risk factors before surgery, perform the operation carefully and

conduct health-related education.

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