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## Case report

## Chemical conjunctivitis and diffuse lamellar keratitis after removal of eyelash extensions

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## ABSTRACT

**Purpose:** There have been several reports in the literature demonstrating the adverse effects of multiple ocular cosmetic procedures, such as eyelash extensions, eyeliner tattoo, and eyelash dyeing. To our knowledge, there is limited literature on the adverse effects specifically attributed to the chemicals and process of eyelash extension removal. Our purpose is to demonstrate the possible ocular injuries from misapplication of eyelash extension removal solvent.

**Observations:** We present a unique case of a 46-year-old female with a prior history of laser assisted in-situ keratomileusis (LASIK) who presented with bilateral chemical conjunctivitis and diffuse lamellar keratitis (DLK) secondary to epithelial defects following the misapplication of eyelash extension removal gel.

**Conclusion and importance:** Given that our patient suffered significant dry eyes, corneal haze, and visual fluctuation, we believe this case underscores the importance of continuing closer and careful evaluation into the chemicals present in these cosmetics to improve the safety of our patients and to limit such incidents from occurring hereafter.

## 1. Introduction

Embellishment of the human body to attain certain conceptions of beauty dates back to ancient Greek civilization when hair of oxen was often used by women to enhance the appearance of eyelashes. Hence forward, the practice of cosmetic based enhancements has exponentially gained popularity worldwide. The most popular procedures include eyelash extensions<sup>1</sup> and permanent eyeliner tattooing.<sup>2</sup> However, with these procedures, there are many adverse effects unbeknown to not only the common user but also clinicians. These range from a minor discomfort to severe allergic and chemical reactions to the products and application techniques.<sup>3</sup> Because of the fragile nature of the corneal epithelium and conjunctiva, these cosmetic enhancements present risk of corneal damage and ocular disorders. We describe a case of a female patient with a prior laser assisted in-situ keratomileusis (LASIK) who presented with bilateral chemical conjunctivitis and diffuse lamellar keratitis (DLK) following the misapplication of eyelash extension removal gel.

## 2. Case report

A 46-year-old female with previous history of LASIK four years ago presented to the emergency department (ED) with bilateral eyelid swelling, redness, photophobia, blurry vision 3 h after eyelash extension removal and permanent eyeliner tattoo augmentation. In order to remove the eyelash extensions, an experienced cosmetic beautician applied the eyelash extension removing solvent (Bella Lash Gel Remover, Bella Lash, Utah Valley, Utah) from the root of the eyelash to the tip using an applicator while the patient's eyes were closed. Immediately, the patient felt a significant burning sensation in both eyes. The beautician flushed her eyes with saline, and the patient subsequently felt comfortable. Afterwards, the beautician started the procedure of eyeliner tattooing by applying a topical analgesic (NUM Quick PINK, KP Permanent Makeup, Phoenix, Arizona; 40% lidocaine and 60% tetracaine;). A stronger topical analgesic was added prior to the application of the tattoo (SSJ 48 Anesthetic Gel, China; Lidocaine HCl 60 mg, Epinephrine HCl 0.4 mg;). Throughout the duration of the

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procedure, the patient was instructed to keep both eyes open. Upon completion of the eyeliner augmentation, the beautician noted significant conjunctival redness and was quite concerned. She drove the patient to the ED, where both of the patient's eyes were immediately irrigated with saline solution for approximately 15–20 minutes. The patient was diagnosed with chemical conjunctivitis, although without slit lamp examination, and was given a 5-day prescription for erythromycin ointment.

She followed up with an ophthalmologist 72 hours later per ED recommendation. At that time, the patient reported bilateral eye lid pain, photophobia, blurry vision, and watery discharge. She had been using erythromycin topical ointment 3–4 times daily OU. On examination, her best uncorrected distance visual acuity (UDVA) was 20/100 OU. Slit lamp examination revealed significant bilateral eyelid edema and conjunctival injection OU with 6 mm by 6 mm epithelial defect encompassing the flap in both eyes. The patient was started on topical moxifloxacin QID OU and loteprednol QD OU with bandage contact lenses (Acuvue Oasis, BC 8.4, Johnson and Johnson, New Jersey). Erythromycin was discontinued. Two days later, slit lamp exam revealed complete resolution of epithelial defect OD with remaining 1 mm by 1 mm epithelial defect OS, and significant improvement of bilateral eyelid edema and conjunctival injection OU. Loteprednol was discontinued and Tobradex QID OU was started.

One week after initial injury, the epithelial defect OS had resolved. Bandage contact lens was removed. There was significant superficial punctate keratopathy (SPK) in both eyes. At the time, the UDVA was 20/25 OD and 20/50 OS. She was switched from Tobradex to Durazol QID OU. Three weeks after initial injury, there was no improvement in patient's visual acuity. She was unable to work longer than 2 h without needing to go home and close her eyes. Slit lamp exam revealed anterior basement membrane changes with significant corneal staining. The patient was subsequently referred to our tertiary care center for further evaluation and management.

At our initial encounter, 4 weeks after the initial insult, she reported ocular pain, bilateral photophobia, dry eyes, and daily headaches. The patient denied any prior history of dry eyes before the incident. Her UDVA was 20/30 OD and 20/40 OS with no improvement with refraction. Extraocular muscles and visual fields were intact. Slit lamp exam revealed a healed epithelial defect overlying the LASIK flaps and significant confluent superficial punctate keratitis of the corneal epithelium more pronounced in the left eye than the right. There was trace corneal haze at the interface of both flaps OU. The rest of the eye exam was otherwise normal. Our immediate impression was most likely a chemical conjunctivitis with a secondary epithelial defect causing diffuse lamellar keratitis (DLK) or perhaps a central toxic keratopathy (CTK). The plan was to taper off the Durazol over six weeks and start the patient on Restasis BID and doxycycline 50 mg PO every day.

A month later, patient continued having dry eyes, photophobia, headaches, and visual fluctuation. UDVA was 20/25 OD and 20/40 OS. Additionally, her manifest spherical refraction was  $-0.75$  D OD and  $-1.25$  D OS with best corrected distance visual acuity (CDVA) 20/20 OD and 20/25 OS. Anterior segment examination revealed diffuse SPK OU, although worse in OS with trace interface haze OU. Permanent plugs were placed in the inferior puncta OU.

Two months later, slit lamp exam revealed further improvement of corneal staining and SPK, more so in the right eye. Patient was placed on autologous serum tears 50% QID OU. Eleven months after initial insult, she persisted to have ocular surface dryness, and patient was prescribed Lacrisert OU. In addition, she continued on doxycycline, Restasis, autologous serum tears, and permanent plugs OU. Over the next several months, there was significant improvement in punctate epithelial staining and clarity of the LASIK flaps. Approximately 3 years after the initial incident, she had moderate but stable dry eye symptoms. Moisture chamber goggles were given in addition to her present medications. At this point, patient had CDVA 20/25 -2 OU with myopic refraction. Slit lamp examination was significant for moderate

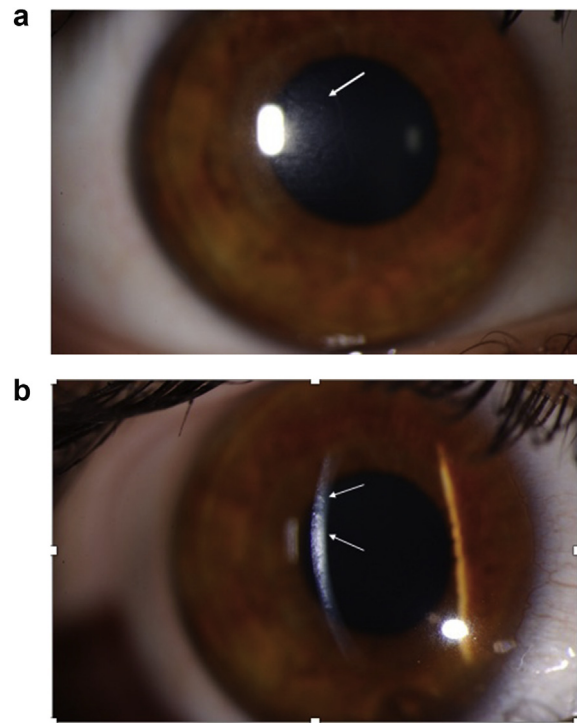


Fig. 1. a: Slit lamp view: Paracentral corneal haze secondary to DLK b: Slit lamp photograph: Interface stromal haze along with SPK at the level of tear film.

meibomian gland dysfunction in both eyes. LASIK flaps were clear in both eyes except for trace central SPK. The rest of the anterior segment exam was unremarkable.

### 3. Discussion

This was a patient presenting with a large epithelial defect overlying a prior LASIK flap secondary to chemical conjunctivitis. It is very likely that the chemical injury not only damaged the corneal epithelium but also the limbal stem cells and the conjunctival goblet cells causing poor epithelial turnover and dry eye symptoms, respectively. This was likely provoked by a severe inflammatory response from the chemical toxins leading to a T-cell mediated release of cytokines and interleukins causing goblet cell dysfunction and apoptosis.<sup>4</sup> Following the healing of the epithelial defect, the patient had a corneal haze paracentral to the pupillary center (Fig. 1a and b). The differential diagnosis was either a previous DLK that had resolved or central toxic keratopathy (CTK). A diagnosis of CTK due to some chemical toxicity was our first impression given her history. Given that the patient did not exhibit evidence of stromal tissue loss, striae, or significant hyperopic refractive shift,<sup>5</sup> this was inconsistent with CTK. Therefore, a resolving DLK was the more likely diagnosis. Due to the delayed recovery of the epithelial defects, we can infer the patient's previous history of LASIK further compromised her situation. This underscores how patients with prior history of LASIK can sometimes be more susceptible to significant damage and slower healing time following a chemical insult.

The most common adhesives used for eyelash extension application are cyanoacrylate based, high in formaldehyde emission, and generally contain latex and ammonia.<sup>6,7</sup> This has been reported to cause contact dermatitis, toxic conjunctivitis, allergic blepharitis, conjunctival erosion, and bacterial keratitis.<sup>1,3,6–8</sup> The release of formaldehyde upon dissolving of the cyanoacrylate combined with the chemical irritants contained in the lash gel remover can account for the inflammation and the subsequent corneal epithelial defects. We know from prior studies that formaldehyde, even at much lower concentrations than contained in consumer products, can significantly inhibit survival and

proliferative ability of the epithelial cells of the Meibomian glands, cornea, and conjunctiva.<sup>9</sup> Conditions likely worsened from exposure to high concentrations of lidocaine and tetracaine administered in the analgesic. Additionally, the long period without blinking during the eyelid tattooing process likely caused even further vulnerability to damage from toxins.

The use of eyelash extension application and removal, as well as permanent eyeliner tattooing, is practiced heavily around the world.<sup>3,8</sup> A significant portion of individuals who use such cosmetic enhancements have reported experiencing ocular symptoms following eyelash extensions. The most common of these involve tearing, burning sensation, itching, redness, pain, and heavy eyelids.<sup>6,7</sup> The ocular disorders most frequently reported include: allergic blepharitis, chemical keratitis, conjunctival erosion, and keratoconjunctivitis.<sup>3</sup> The majority of the cases reporting adverse effects analyzed the glues used for adhesion and discovered they contained high emissions of formaldehyde thought to trigger the irritation and severe symptoms.<sup>8</sup> Moreover, the removal of eyelash extension has been shown to cause an increase in follicle tension, subconjunctival hemorrhage from compression during removal, and damage via chemical solvents.<sup>1,8</sup>

The process of permanent eyeliner tattooing has been implicated in a variety of complications including: cilia loss, eyelid scarring, infections, as well as severe corneal staining and erosion.<sup>3,10</sup> Reactions to the tattoo ink have also been reported to result in blepharitis, dermatitis, granulomas, and recurring inflammation.<sup>2,11</sup> In addition, there has also been a report of DLK one week after permanent eyeliner tattoo augmentation.<sup>10</sup>

#### 4. Conclusion

We believe our patient's chemical conjunctivitis and DLK was mainly attributed to the eyelash removal solvent seeping into the patient's eyes. However, a history of LASIK, exposure to high concentrations of lidocaine and tetracaine, eyelid tattooing, and prolonged periods without eyelid closure were all significant contributing factors to the patient's symptoms and disease. Our patient suffered many years of significant dry eyes, poor visual acuity, visual fluctuation, intermittent headaches, and significant functional impairment as she was unable to work for months. Therefore, we recommend continuing further evaluation into the chemicals of these cosmetics to improve safety and prevent such incidents from occurring.

#### Patient consent

Written consent to publish case details was obtained by the patient.

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#### Conflicts of interest

All authors have no financial disclosures.

#### Authorship

All authors attest that they meet the current ICMJE criteria for Authorship.

#### Disclosure

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#### Appendix A. Supplementary data

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