My Tattoos Caused My Dry Eye?

A New Way To Look At Diagnosis And Treatment For Patients With Tattoo Eyeliner

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Abstract

Purpose: This case report describes the potential impact of tattooed eyeliner on eyelid structure and function resulting in an increase in dry eye symptoms and findings.

Case Report: A 59-year-old Hispanic female presented for an evaluation following longstanding dry eye symptoms with little relief from artificial tears. Imaging showed meibomian gland dropout, possibly a result of her tattooed eyeliner. Symptoms and objective measurements improved successfully with warm compresses, lid massage, and lipid-based artificial tears.

Conclusions. Permanent tattooed eyeliner may enhance dryness of the eyes in two main ways: disruption of the architecture of the lids and chronic inflammation from tattoo pigment granules. Recognizing these possible effects in patients with tattooed eyeliner may help tailor treatment to be specific to the etiology of the patient's dry eye: aiding the remaining meibomian glands by utilizing warm compresses, lid massage and supplementing the lipid from the missing meibomian glands by employing lipid-based artificial tears.

Introduction

Dry eye disease has a worldwide prevalence of between 5% and 34% of the population, and is divided into two etiology subgroups: aqueous-deficient, and hyper-evaporative.[1] Aqueous-deficient dry eye occurs when the lacrimal gland does not produce enough aqueous tears to lubricate the eye. This form only accounts for about 10% of dry eye. The more common form, and the etiology detailed in this case report, is hyper-evaporative. Hyper-evaporative dry eye results from the dysfunction of the meibomian glands under-secreting the lipid layer needed to maintain the aqueous tears on the eyes. Hyper-evaporative dry eye and mixed hyper-evaporative/aqueous-deficient forms account for about 80% of all forms of dry eye.

Case Report

A 59-year-old Hispanic female was referred by her primary eye care practitioner for a dry eye evaluation. She had longstanding symptoms of dryness, mild ocular itching associated with pollen allergies, and mild ocular burning. She reported tearing following extensive television or computer usage, although tears did not run down her checks. The duration of these symptoms was unknown. She had been using ketotifen ophthalmic drops twice a day (BID) and Systane Ultra artificial tears (Alcon Laboratories, Inc) BID in both eyes. She had never used warm compresses and had no history of compress recommendation. Permanent eyeliner had been placed on both upper (yellow ink) and lower lids (black ink) around 25 years ago although the lower lid liner was not visible because it dissolved when the patient used a skin bleaching cream. There is no history of contact lens wear. The patient had been diagnosed with type II diabetes for about 4 months with unknown sugar levels, and takes 3 Metformin 500 mg tablets by mouth BID.

Pertinent findings during her initial exam included a corrected visual acuity of 20/20 at both distance and near. On slit lamp examination, tattooed eyeliner was noted on the upper lids of both eyes (Figure 1). Mild meibomian gland dysfunction was found with capped gland orifices and turbid secretions on digital expression in both eyes (OU). Corneas showed superficial punctate staining with sodium fluorescein inferiorly OU. The practitioner measured tear break up time (TBUT) to be 2 seconds in each eye. Lissamine green dye stained only nasal and temporal pingueculae OU. Jones 1 Test, performed in response to her symptoms of tearing, demonstrated that the tear ducts and lacrimal drainage system were patent OU.

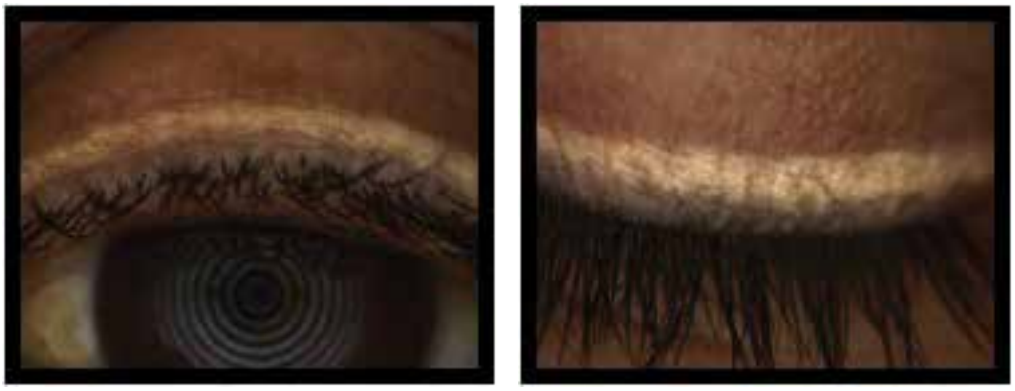

Figure 1. Tattooed eyeliner on upper eyelids.

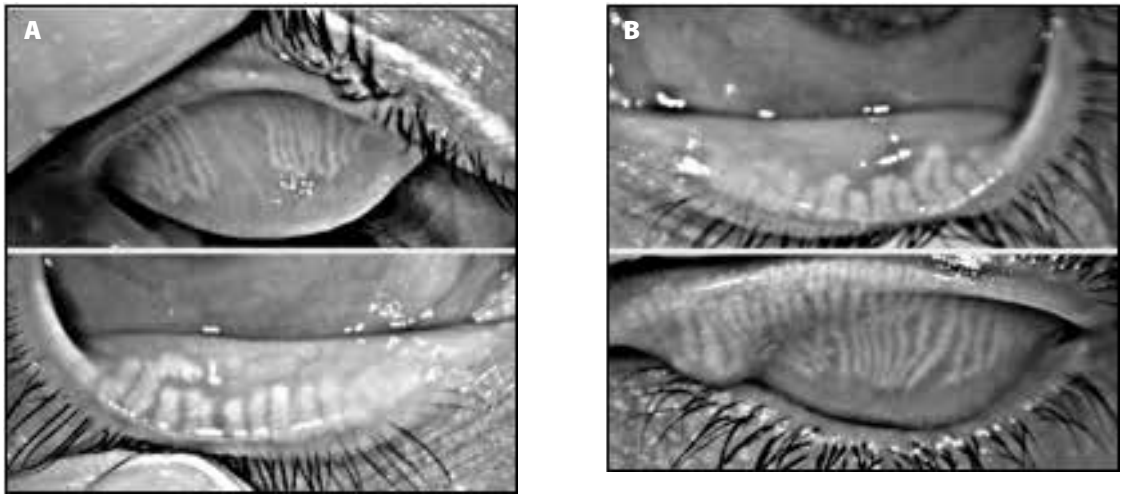

Figure 2. Oculus Keratograph 5M Meibomography (Oculus, Inc.) a) Right eye (OD) arrows pointing to meibomian gland drop out (upper lid) and shortening of the meibomian glands (lower lid).
b) Left eye (OS) arrows pointing to shortening of the meibomian glands (upper and lower lids).

An Oculus Keratograph 5M (Oculus, Inc.) was utilized to quantify dryness by measuring an objective TBUT. In the right eye, tear break up in the central cornea was 7.65 seconds and average across the entire cornea 16.55 seconds (Figure 3). Left eye showed central breakup 7.84 seconds and average across the entire cornea 15.05 seconds (Figure 4). Infrared meibomography images were acquired with the Keratograph, revealing the physical meibomian gland structure. The meibomian glands of the right eye showed a distinct area of meibomian gland drop-out in the upper lid with shortening of the remaining meibomian glands on both upper and lower lids. Imaging of the left eye also revealed shortening of the meibomian glands on both upper and lower lids (Figure 2).

Secondary to the findings, a diagnosis of Meibomian Gland Dysfunction was made. The tattooed eyeliner was suspected as being a contributing factor to the etiology of the condition. The first treatment strategy was to support the function of the remaining meibomian glands by adding warm compresses and lid massage 3 times a day in addition to increasing the use of Systane Ultra artificial tears from 2 to 4 times a day OU.

At a 2-week follow up visit, the patient reported that her symptoms of dryness and burning had decreased. She reported excellent compliance with all dry eye treatment measures. Quantitatively, the central corneal TBUT with the Keratograph 5M was increased in the right eye by 29.9% to 9.94 seconds. The left eye had an increased TBUT by 47.9% to 11.60 seconds.

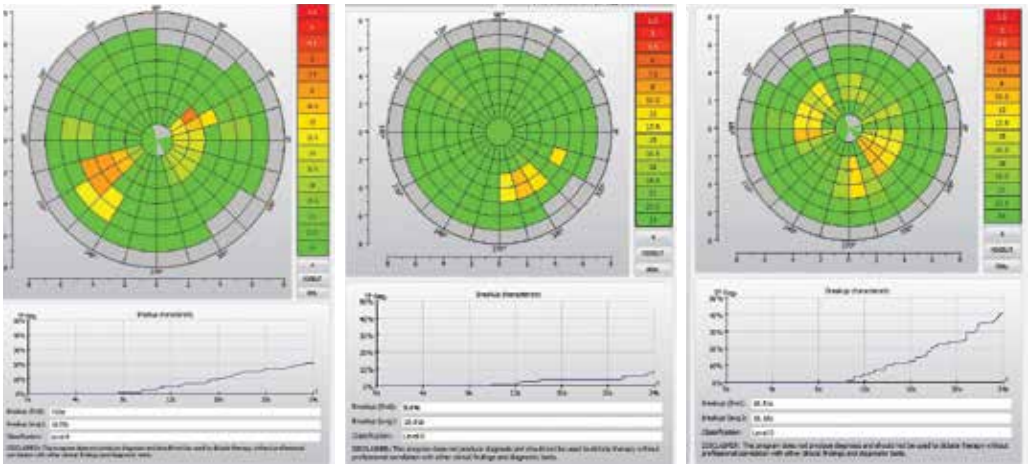

Figure 3. Oculus Keratograph Tear Break Up Time (Oculus, Inc.)
Right eye (left to right) Initial exam, Second Follow Up, Third Follow Up.

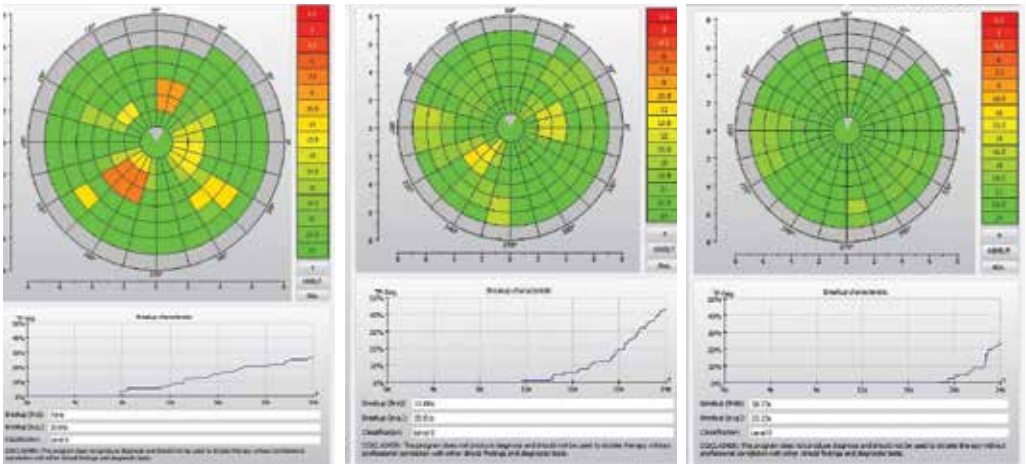

Figure 4. Oculus Keratograph Tear Break Up Time (Oculus, Inc.)
Left eye (left to right) Initial exam, Second Follow Up, Third Follow Up.

Practitioner examination of TBUT was improved from 2 to 3 seconds OU. Sodium fluorescein staining of the cornea and lissamine green staining of the conjunctiva was decreased OU.

To further supplement the lipid layer of the tears, the artificial tears were switched from Systane Ultra to Systane Balance (Alcon Laboratories, Inc). Systane Balance is a lipid-based artificial tear as opposed to Systane Ultra which is an aqueous-based artificial tear. One study reported that the usage of Systane Balance improved tear breakup time by 33% in 49 patients with meibomian gland dysfunction, as opposed to habitual dry eye therapy.[2]

Two months later, at the second follow-up examination, the patient reported increased relief with Systane Balance versus Systane Ultra. The TBUT measured by the Keratograph 5M improved from baseline by 34.7% (10.31 seconds) in the right eye and by 138.7% (18.72 seconds) in the left eye. Practitioner examination of TBUT showed increase from baseline from 2 to 5 seconds in the right eye and 2 to 7 seconds in the left eye. There was only a trace amount of superficial punctate staining inferiorly in the right eye and no staining in the left eye with sodium fluorescein. Lissamine green staining was unchanged from the first follow up appointment.

Based on her response to therapy, we confirmed our patient's diagnosis of Meibomian Gland Dysfunction in both eyes. She was educated that this would be an on-going condition requiring long-term management and instructed to continue her daily use of warm compresses and lid massage 3 times a day with Systane Balance artificial tears (Alcon Laboratories, Inc.) 4 times a day She was directed to return to clinic in six months for her annual comprehensive eye examination.

Discussion

Meibomian gland dysfunction (MGD) is characterized by terminal duct obstruction and qualitative and quantitative secretion changes of the meibomian glands.[3] In a patient with permanent tattooed eyeliner, it is theorized that the 2 main causes of increased dryness stem from the disruption of the architecture of the eyelids during the tattooing procedure and the body's resulting inflammatory reaction to the pigment molecules in the ink. With 42.4% of plastic surgeons offering the procedure of permanent makeup, it is important to keep the effects of the procedure on the lid in mind when seeing patients.[4]

The anatomy of the eyelid from anterior to posterior includes the epidermis, dermis, orbicularis muscle, and the tarsal plate. The meibomian glands are located in the tarsal plate and while the tattoo needle aims only to place the pigment in the anterior dermis, it is possible for the needle and the pigment to penetrate deeper than expected.[5] If the procedure is performed incorrectly, the needle depth may be deep enough to disturb the area where the meibomian glands are located. The inflammation induced by this type of trauma could result in gland damage with resulting shortening and dropout.[6,7] There have been reports of the tattoo needle going so deep as to lacerate the eyelid, placing tattoo ink in the bulbar conjunctiva.[6] These reports are further evidence that the architecture of the lid, including the meibomian glands can be affected by both the tattoo needle and pigment.

A second method by which tattooed eyeliner can exacerbate dry eye is through the reaction of ink particles with lid tissue which have the potential to cause a low grade chronic inflammation.[1] This inflammation can damage structures that produce the layers of the tear film such as the accessory lacrimal Glands of Wolfring and the meibomian glands. The Glands of Wolfring are located in the palpebral conjunctiva and similar to the main lacrimal glands, produce a secretion of electrolytes, fluid, and protein that lubricates the ocular surface.[8] The meibomian glands produce a lipid material that acts as a barrier to evaporation between the aqueous tears and the outside environment.[9]

The tattoo ink has been shown to contain carbon nanoparticles along with other additives and water.[10] These nanoparticles may induce reactive oxygen species in the skin causing inflammation. Histopathologic specimens taken from the eyelid after tattooing showed focal chronic inflammation without granulomas.[11] Histology also showed dermal fibroblasts laden with black granular pigment. Some of the chemicals in sample black ink include arsenic and P-phenylenediamine, which have been reported to cause reactions, specifically hypomelanosis in the skin. In the United States, the composition of tattoo ink is subject to the Food and Drug Administration regulation, although the practice of tattooing itself is not.[5] Therefore, many of the pigments used may not be approved for skin contact, and no pigment is approved for injection or implantation into the skin. When tattoo ink pigment is placed in one area, it is possible for the ink to have a spreading effect, infiltrating multiple layers of the eyelid.[12] Chemical changes, therefore, make take place in unintended tissues. Furthermore, allergic granulomatous reactions to ink particles can occur, presenting with tenderness, swelling, itching, and bumps.[13,14] One study conducted interviews of 92 patients with adverse reactions to permanent makeup procedures. Of these patients, 68% had unresolved reactions at the time of the interview (duration of symptoms ranging from 5.5 months to 3 years), showing possibility for chronicity of the inflammatory reaction.[13]

A recently published study directly linked tattooed eyeliner with meibomian gland loss and tear film instability.[3] The study involved 40 women, 10 with tattooed eyeliner, and 30 without (control group). The study proved statistically significant results for those with tattooed eyeliner having greater corneal erosion, lower tear secretion volume, lower TBUT, and greater meibomian gland loss.

In our patient, use of warm compresses and lid massage allowed the remaining functioning meibomian glands to increase secretion of the lipid layer of the tear film. Lipid-based artificial tears were added to supplement the lipid aspect of the meibum that the missing glands were unable to secrete. Both of these treatment measures provided the patient with a more stable tear film, a decrease in dry eye symptoms, and improved objective clinical measurements. It is possible that our patient would have had meibomian gland dysfunction and dry eye symptoms regardless of the tattooed eyeliner. However, even though the literature is limited, we cannot discount any contribution the tattooed eyeliner had with her meibomian gland loss. As it is a common procedure for women to undergo, it is important to take tattooed eyeliner and its potential effects on the meibomian glands into account when assessing the etiology of a patient's dry eye.

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