

Corneal Erosion With Pigments Derived From a Cosmetic Contact Lens: A Case Report

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Purpose: To report a case of corneal erosion with pigments derived from a cosmetic contact lens (CCL).

Methods: A 29-year-old woman complained of foreign body sensation after wearing CCL. Slit-lamp examination of her left eye revealed corneal erosion with yellow pigment at its edges. The surface of the CCLs was examined using the rub-off test and scanning electron microscopy (SEM). An elementary analysis using SEM with energy-dispersive x-ray (SEM-EDX) was also performed.

Results: On the back surface of the CCL, the pigments easily came off during the rub-off test. An SEM examination found exposed pigments with needle-like construction on the back surface. SEM-EDX revealed the presence of carbon, oxygen, iron, titanium, and chlorine in the pigments.

Conclusion: Direct contact between the bare pigments on a CCL and the corneal surface can cause corneal damage.

Key Words: Cosmetic contact lens—Corneal erosion—Pigments.

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Recently, the use of cosmetic contact lenses (CCLs) has become increasingly popular, especially in Asian countries.^{1,2} Although the pigments of the CCLs are usually embedded within the lens, in some lenses the pigments are simply coated on the surface of the lens.^{3,4} Although it has been suspected that these exposed pigments on the CCL could cause corneal epithelial damage, there has been no definitive evidence that the pigments are harmful by themselves to the corneal epithelium. We report a corneal erosion case with pigments that were derived from a CCL. To assess the possibility of corneal damage induced by the pigments of the CCL, we examined the lenses using the rub-off test, scanning electron microscopy (SEM), and SEM with energy-dispersive x-ray analysis (SEM-EDX).

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CASE REPORT

A 29-year-old woman complaining of foreign body sensation in her left eye was examined in the emergency clinic at the Department of Ophthalmology at Nagasaki University Hospital. She showed a history of psychiatric treatment, angina, and hypertension. The patient had been wearing hard contact lenses since she was 15 years old. Based on a friend's advice, she decided to purchase daily disposable CCLs through the internet. On the day of the incident, she put in the new CCLs for the first time in the morning, but by the afternoon, she began to notice a foreign body sensation in her left eye. After removing the lens and performing self-examination, she found no abnormality in her eye. The sensation decreased after use of unknown commercial eye drops which she bought at a pharmacy. She continued to use the same CCL and in the evening, the foreign body sensation once again returned, with an increase in the intensity. A second self-examination revealed an opacity in her left cornea and thus, she immediately visited the emergency clinic at the Department of Ophthalmology at Nagasaki University Hospital.

Diffuse and moderate bulbar conjunctival hyperemia was noticed during the initial clinical examination of her left eye. Diffuse superficial punctate keratopathy was noted in both corneas. In her left eye, a 1.0 to 1.5 mm width erosion with yellow pigment at its edges was observed in the inferior nasal quadrant of the

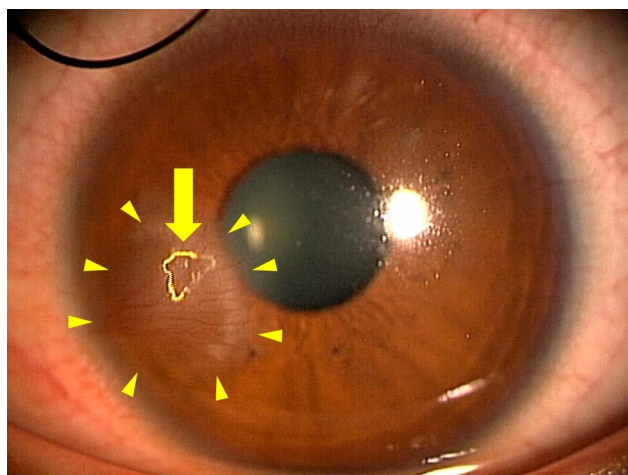
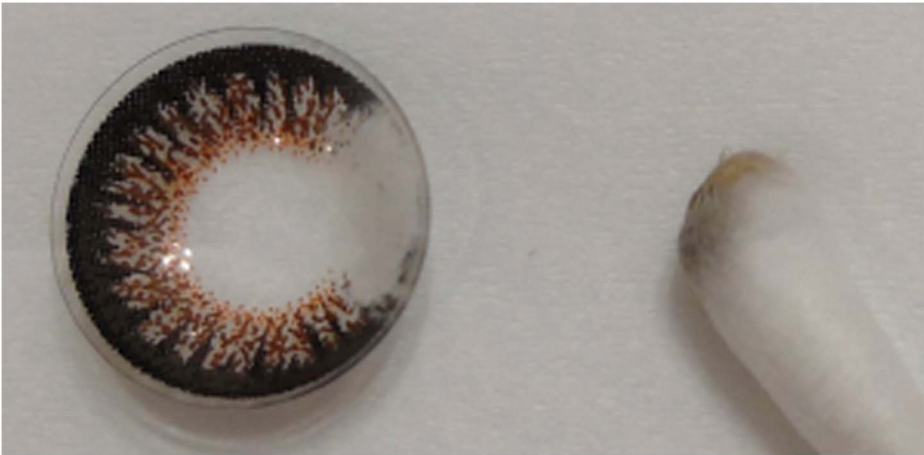


FIG. 1. A slit-lamp photograph demonstrating an erosion in the inferior nasal cornea with yellow pigment at its edge (arrow) and deep stromal neovascularization and opacity around the erosion (arrowheads). The erosion was stained with fluorescein.

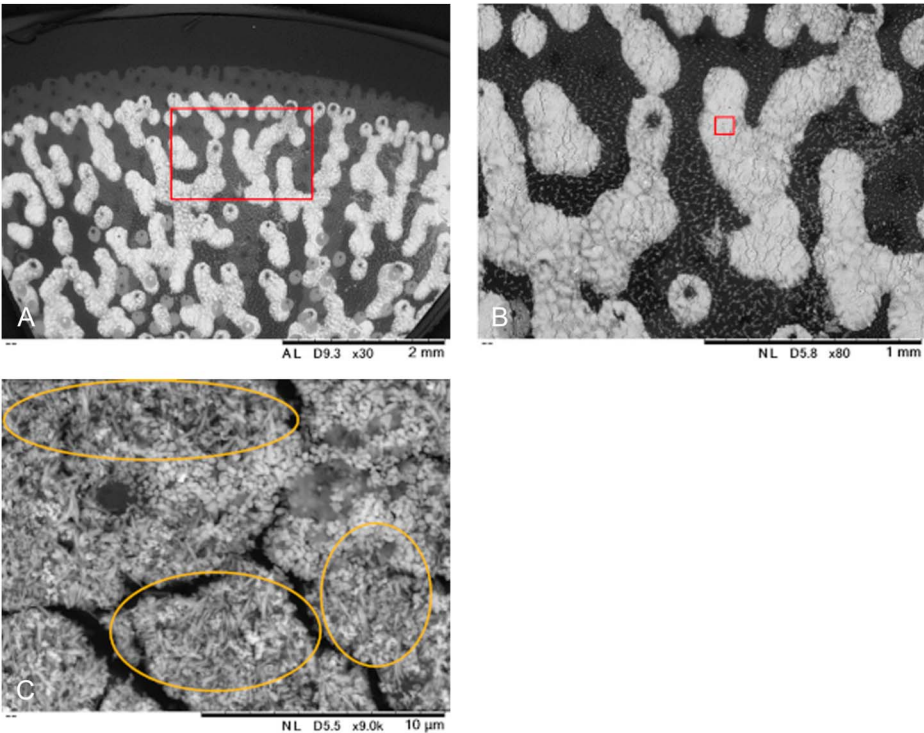
FIG. 2. The rub-off test showed the CCL failed in our case, with pigments easily coming off the back surface of the CCL.



cornea (Fig. 1, arrow). Although there was deep corneal stromal neovascularization and opacification around the erosion (Fig. 1, arrowheads), no inflammatory cells in the anterior chamber or other abnormalities were found. Visual acuity and intraocular pressure were planned to be measured at the next visit. She was diagnosed with traumatic corneal erosion caused by CCL use. A foreign body needle was used to remove the attached pigments at the erosion under topical anesthesia. After washing the eye with 500 mL of saline, the patient was given levofloxacin and bromfenac eye drops to protect against infection and relieve any inflammation. The patient was advised to stop wearing contact lenses. Although the patient had scheduled a follow-up appointment, she did not return for further evaluations.

Although CCL is suspected to contain bare pigments on the back surface of the lens, information on the vendor's internet home page claims the pigments are embedded within the lens. We preserved the patient's CCLs in saline. Several days later, we performed a standardized rub-off test,³ which is used to determine whether CCL pigments are coated on or embedded in the lens surface. In this test, surface of contact lens is gently rubbed with a wetted cotton bud for a maximum of 20 times. If pigments from the lenses are transferred to the cotton bud, the lenses are considered to have failed the test (i.e., pigments are coated on the surfaces). In our patient case, the lens failed in the rub-off test, because the pigments easily came off the back surface of the CCL (Fig. 2). One month later, we evaluated the patient's contralateral

FIG. 3. (A) Scanning electron microscopy photograph of the back surface of the CCL with low magnification. Peripheral area of the lens showed rough surface with pigments. (B) High magnification of squared area of Figure 3A shows rough surface of the pigmented area of the CCL. (C) High magnification of squared area of Figure 3B shows needle-like constructions (circles) of the pigmented area of the CCL.



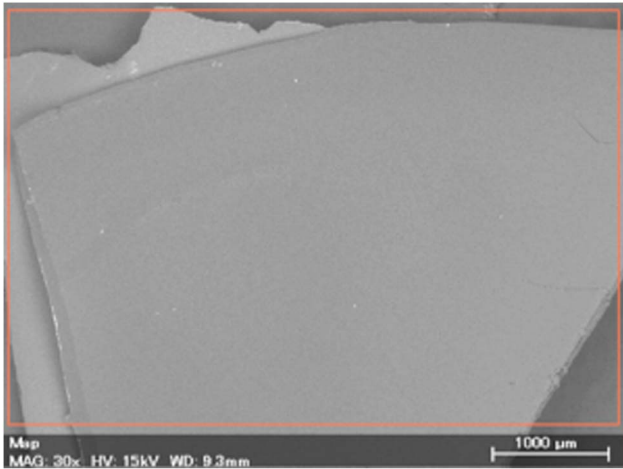


FIG. 4. Scanning electron microscopy photograph of the front surface of the lens showed that there was a smooth surface without any pigments.

CCL using SEM, which revealed there was an exposure of pigments with needle-like construction on the back surface (Fig. 3A, B, C). The front surface of the lens exhibited a smooth surface

without any pigments (Fig. 4). SEM-EDX elementary analysis of the CCL pigments in this case found the presence of carbon, oxygen, iron, titanium, and chlorine (Fig. 5).

DISCUSSION

The use of CCLs (also known as beauty or decorative contact lenses) has become increasingly popular, especially in Asian countries. The 2010 Study of the International Market for Contact Lenses conducted by the Multi-sponsor Surveys International LLC reported that the use of cosmetically tinted lenses among all contact lens wearers ranged from 24% in Taiwan to 39% in Singapore.^{1,2} The primary wearers of CCLs are usually teenagers and adolescents. In the UK, cosmetically tinted lens tend to be fitted to younger patients (average age 27 ± 11 years) compared with noncosmetically tinted lenses (33 ± 13 years).⁵ Because of the increasing popularity of CCLs, they are now being classified as medical devices in Japan and in many other countries.³ However, many studies have reported cases of ocular complications related to the use of cosmetically tinted contact lenses obtained from unlicensed retail vendors.^{6–8} Moreover, CCL users tend to wear these lenses without proper lens fitting, wear and care instructions, or periodic eye examinations. In Japan, only 13.4% of CCL users reported visiting an ophthalmologist before purchasing/using the lenses, whereas 80.3% of the users

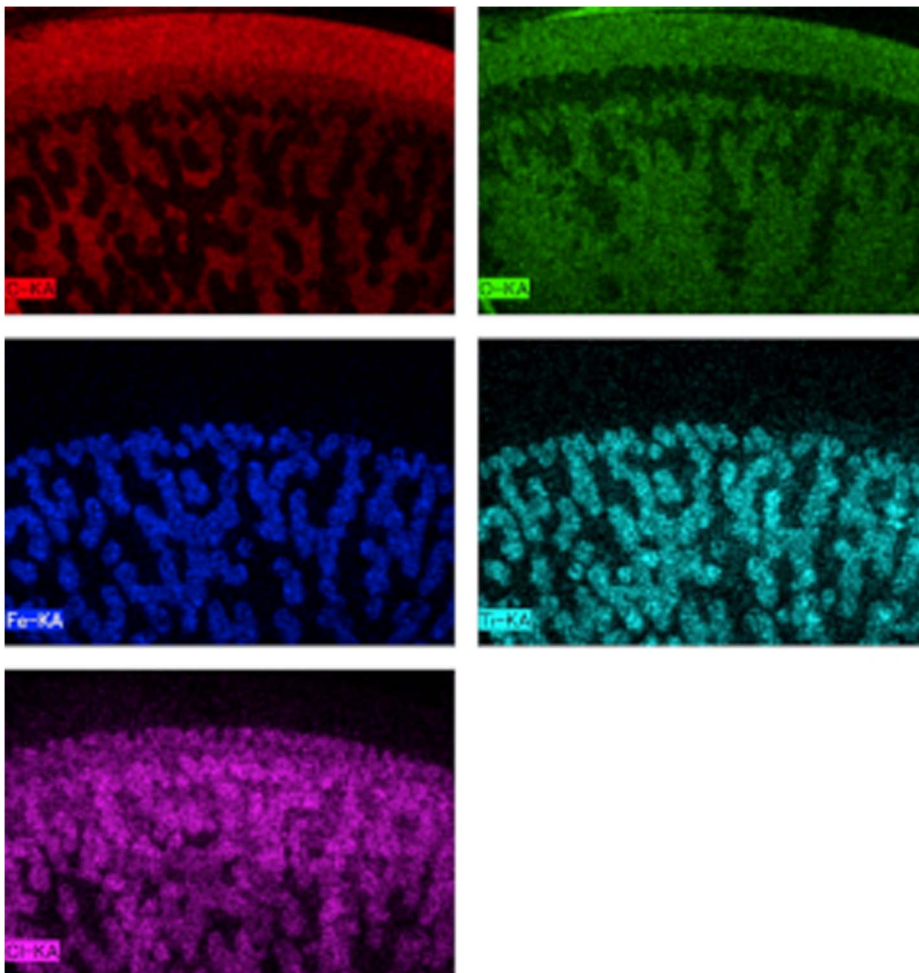


FIG. 5. SEM-EDX elementary analysis photographs indicated the presence of carbon, oxygen, iron, titanium, and chlorine.

have purchased and then used these lenses without any previous consultation with an ophthalmologist.⁹

The findings in our current patient were typical of corneal abuse cases usually seen in CCL wearers. Although this 29-year-old woman had previously worn hard contact lenses prescribed by an ophthalmologist, she purchased and wore CCLs without any previous consultation with an ophthalmologist. Although she claimed that she had never worn CCLs before, the observed erosion was accompanied by neovascularization around the corneal lesion, which suggests a history of chronic corneal inflammation, which may have been caused by persistent mechanical irritation or a previous episode of corneal trauma. The patient did not volunteer any information about previous corneal events and did not return for follow-up on this event indicating poor adherence to medical care.

Both the quality of the CCLs and the distribution of the pigments inside a CCL are of concern. Ideally, the pigments should be embedded or sandwiched inside a CCL to avoid direct contact of the pigments with the cornea or the eyelids. The rub-off test is an indirect method that is used to confirm whether or not CCL pigments are embedded within the lens material. Chan et al. showed that most of the CCL brands tested in their study failed the rub-off test.³ In lenses where the pigments are not correctly embedded in the material, the pigments increase the surface roughness of the CCL, which can cause mechanical abrasion to the cornea. It has been shown that the surface roughness may also have an effect on bacterial adhesion.¹⁰ Thus, corneal erosion and bacteria on such contact lenses could contribute to the development of microbial keratitis. Moreover, low-graded material often used in CCL can reduce the oxygen permeability, which may cause hypoxia of the corneal cells.⁹

In the current case, the pigments derived from the CCL were attached to the margin of the corneal erosion, which implied that the pigments were in direct contact with the cornea, thereby damaging the area. The rub-off test in this case showed that the CCL failed, whereas the SEM evaluation revealed that there were bare pigments on the back surface of the lens. The needle-like construction of these pigments most likely increased the friction between the CCL and the cornea and caused the corneal damage.

Although the vender for these CCLs claimed that the pigments are embedded within the CCL, we find this to be questionable. In addition, spectrometry revealed the presence of chlorine in these pigments, which may have also increased the possibility of corneal toxicity.⁴ Further studies will need to be undertaken to definitively determine the effect on the cornea of each of the elements that are present within these pigments.

The simplest and best way to avoid eye problems is to follow proper lens care guidelines as prescribed by eye care professionals. Ophthalmologists must have an important role to advocate necessity of proper care for the contact lenses. At the same time, the safety of CCLs, especially those with pigments coated on the surface, requires added attention. Both users and clinicians need to be aware that the bare pigments found on CCLs can cause corneal damage when there is direct contact with the corneal surface.

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