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Retained polyvinyl chloride fragments in the cornea following trauma

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ABSTRACT

Purpose: PVC is a synthetic plastic polymer used worldwide for a wide range of applications. While it is often associated with ocular trauma, little is known regarding how PVC may interact with ocular tissues. Herein we report the clinical course of a patient with polyvinyl chloride (PVC) embedded in the cornea after a projectile injury, utilizing anterior segment optical tomography to study the relative antigenicity and reactivity of this industrial material in the cornea.

Observations: A 29-year-old male presented with acute, unilateral vision loss in the left eye following ocular trauma while working with PVC. On exam, he had a near full-thickness corneal laceration with multiple small fragments of PVC in the corneal stroma. Given the small size and depth of the fragments, the patient was medically managed with close follow-up. After 6 days, his visual acuity returned to baseline and the corneal laceration was found to be well healed. Anterior OCT imaging identified discrete, individual fragments and there was no associated inflammatory response. At 3 months, the patient continued to do well with no signs of ocular inflammation.

Conclusions and Importance: PVC is a commonly used plastic in workplace settings that pose a risk for projectile injuries to the eye. This case highlights that at least in the short-term, PVC appears to be inert in the corneal stroma, allowing for medical management and close follow-up, rather than surgical removal.

1. Introduction

Ocular trauma is the most common eye-related presentation in the emergency department (ED), accounting for approximately 3% of all ED visits.[1] Roughly 80% of these patients present with corneal injury, including partial- and full-thickness corneal lacerations.[1] In addition to ocular tissue damage, corneal lacerations may be associated with high velocity projectiles resulting in retained fragments of foreign material in the cornea. Clinical outcomes vary with the material of the foreign body, speed of entry, extent of injury, associated infections, and the time lapse between injury and medical care.

Work-related injuries are the most common etiology of ocular foreign bodies, particularly from hammering, thus materials involved in workplace construction can pose a significant risk for patients.[2] Polyvinyl chloride (PVC) plastic is one of the most common plastics used worldwide, accounting for roughly 13% of global plastic demand, and is especially prevalent in plumbing and construction.[3] Yet despite its prevalence, little is known regarding how this industrial material may interact with ocular tissues, including the cornea. To improve our ability to manage patients with PVC-related ocular injuries, we present the clinical course of a patient with multiple PVC fragments retained in the cornea. Furthermore, for the first time, we present anterior segment optical tomography imaging to localize the PVC fragments and to understand the reactivity of this material in the cornea.

2. Case

A healthy, 29-year-old man presented with acute pain, loss of vision, and flashes in his left eye following a traumatic plumbing incident. On exam his visual acuity was 20/20 in the right eye and hand motion in the left eye. His intraocular pressure was 15 in the right eye and 16 in the left eye. Extraocular movement was full and without pain. Slit lamp exam (SLE) revealed a near-full thickness inferior corneal laceration (Seidel negative) extending 4.5 mm in total length, just inferior to the visual axis and was associated with significant corneal edema. The patient was also noted to have 3+ cell and flare, and a 1.5 mm layered hyphema. Of note, there were no obvious corneal foreign bodies identified on this initial exam. The posterior exam was limited secondary to a poor view,

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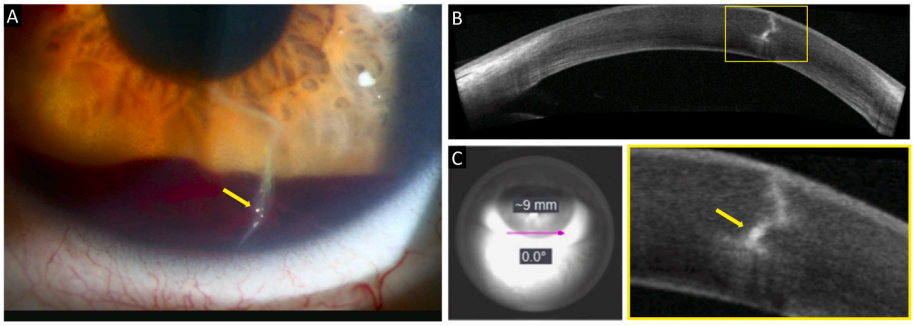

Fig. 1. Slit-lamp image and corneal OCT of embedded polyvinyl chloride fragments
(A) Slit lamp image of left eye 3 days after injury. A jagged corneal laceration is visible on the inferior portion of the cornea. Small white flecks can be seen at the most inferior aspect of the laceration as indicated by an arrow Fluorescein dye stains the upper 2/3 of the laceration. An underlying hyphema in the anterior chamber and endothelial pigment can also be appreciated. (B–C) High resolution OCT of the cornea demonstrates partial thickness scarring from the laceration. A spot of hyperreflectivity within the corneal stroma corresponds with the largest fleck seen in the slit-lamp image (yellow arrow). (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article.)

however gentle ultrasound showed no evidence of intravitreal foreign bodies, vitreous hemorrhage, retinal tears, detachments, or choroidal hematoma.

The patient's initial management included cyclopentolate 2% twice daily, prednisolone 1% four times daily, and moxifloxacin four times daily. Prior to discharge he was also given a single dose of 400mg IV moxifloxacin for infection prophylaxis. On follow-up the next day, his exam improved including partial resolution of the corneal edema, revealing several small PVC fragments that were now visible at the base of the laceration. Given the small size of the foreign bodies and improving clinical course, the decision was made to continue with medical management and observation. On day 3 the patient's visual acuity had improved to 20/40–2, with significant improvement in corneal edema as well as the hyphema. Slit lamp photos and high-resolution corneal optical coherence tomography (OCT) were taken at this time and are shown in Fig. 1. The findings on OCT demonstrate a partial-thickness laceration extending to the mid-stroma with increased hyperreflectivity at the base of laceration, corresponding to the largest PVC fragment on slit lamp exam. By day 6, his symptoms had resolved, and his VA had returned to 20/20. Given the unknown reactivity of the PVC fragments, the patient was maintained on topical prednisolone four times daily for a total of 2 weeks followed by a slow taper of three times daily for 5 days, two times daily for 5 days then once daily for 5 days before discontinuing this medication.

The patient successfully completed the taper without an inflammatory response. Three months following the initial injury, his exam remained stable with a visual acuity of 20/20, normal intraocular pressure and no signs of ocular inflammation. He will continue to be monitored intermittently for a delayed inflammatory response.

3. Discussion

There have been few case reports to date examining the clinical course of ocular trauma with PVC. A case report by Duker and Fischer in 1989 attributed an atypical, post-traumatic uveitis to an inflammatory response to PVC plastic that had been retained in the vitreous cavity after a projectile injury.[4] Another report by Lin, Wang, and Lai in 2006, found that an intravitreal PVC fragment was retained in one patient for 30 years after ocular trauma without consequence, suggesting a lack of inflammation to intraocular PVC.[5] The incongruity between these case reports raises questions as to the true effect of PVC in ocular tissue, and which additional variables might trigger a potential inflammatory response. While other studies have demonstrated non-PVC plastics to be inert in ocular tissue,[6] commercial PVC often contains additives such as plasticizers, stabilizers, antioxidants, and pigments, any one of which may cause damage or inflammation in human tissue.

This report is the first to our knowledge that considers PVC embedded in the cornea. Additionally, for the first time, anterior segment OCT was successfully utilized to identify PVC fragments as hyperreflective spots at the base of the laceration. While in this case we opted to closely observe the patient's course, this report demonstrates the ability to locate plastic material in the cornea with OCT which is invaluable should future surgical removal be considered.

Although more follow-up is necessary to understand potential long-term sequelae such as a hypersensitivity reaction, in the short-term, intracorneal PVC appears to be non-inflammatory both from clinical exam and by anterior segment OCT imaging. Thus, this material appears non-toxic, and in some cases may be monitored with routine follow-up.

Patient consent

Written consent to publish this case report has not been obtained. This report does not contain any personal identifying information.

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Declaration of competing interest

The authors have no financial disclosures or conflicts of interest to report. Authorship: All authors attest that they meet the current ICMJE criteria for Authorship.

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