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Penetrating ocular injury from motor vehicle rear-view side-mirror

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ABSTRACT

Purpose: To report a case of penetrating ocular injury due to automobile rear-view side-mirror.
Observations: This is a case of a 49-year-old male who developed penetrating eye injury with a full thickness corneal laceration after isolated motor vehicle damage to the rear-view side-mirror. This patient subsequently required surgical repair of the corneal laceration and likely will need further surgical interventions in the future for ocular rehabilitation.
Conclusions and Importance: Our case of rear-view side mirror caused injury and those previously reported highlight an area of opportunity for injury prevention.

1. Introduction

Motor vehicle collisions (MVC) are some of the most common causes of injury in the United States and can be associated with a variety of ocular injuries. It has been estimated that, from 2001 to 2009 approximately, it has been estimated that approximately 9.7% of all emergency department visits for non-fatal injuries are due to MVC's, and 0.3% of these have ocular involvement.[1] MVC ocular injuries are thought to represent less than 5% of total and the most common source of ocular injury in MVCs are from the windshield followed by frontal air bag, steering wheel, and flying glass.[2]

The Federal Motor Vehicle Safety Standards specify a variety of requirements, including material, strength, visibility, chemical resistance, and mounting standards for modern motor vehicles. One important advance in motor vehicle glass safety has been the introduction of treated glass, such as laminated or tempered glass.[3] These specially treated glass materials allow for increased strength and reduction in free fragments when broken, which have led to reduction in laceration injuries.[3,4]

Morbidity and mortality via laceration and ejection has been greatly reduced via introduction of and specific regulation of treated glass windows and windshields. However, injuries caused by rear-view side-mirrors have not received great attention, and there are no current standard regulations.[3,5] There have been 4 case series that documented rear-view side-mirror glass related penetrating ocular injuries documented in Australia, the United Kingdom, and most recently the United States. We report another case of side-mirror induced globe injury to help further elucidate potentially serious morbidity imparted by automobile rear-view side-window glass.

2. Case report

A 49-year-old healthy male presented to the emergency department with the complaint of decreased vision in the left eye. The patient states that he had been smoking while driving with the driver's side window down when a passing vehicle struck the rear-view side-mirror on the driver's side. The patient felt an object striking his left eye followed by a gush of fluid that extruded from the eye. Since that time the patient had markedly decreased vision in the affected eye, and he came immediately to the emergency department. Generally, the patient was comfortable without any facial or periorbital signs of trauma. Upon initial evaluation of the left eye the patient's visual acuity was 20/400 and pupil was peaked inferotemporally. On slit lamp exam, there was a full thickness corneal laceration spanning from 4 o'clock to 7 o'clock and a 2mm scleral laceration extending from the corneal laceration at 4:30 o'clock superiorly along the limbus. The corneal laceration had self-sealed and was Seidel test negative. The anterior chamber was formed with no iris-corneal touch. The anterior capsule was ruptured and the lens was opacified. No foreign bodies were noted. Computerized tomography in the emergency department demonstrated the left globe to be decreased in size and irregular in shape without any retained foreign body.

In the operating room the full thickness corneal laceration from 4 to 7 o'clock was confirmed along with a partial thickness flap at 4 o'clock. The anterior chamber was noted to be formed without any iris-corneal

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touch, and the lens was noted to be opacified with violation of the anterior lens capsule. No foreign bodies were noted. The protruding lens material was removed, and remaining intraocular lens material was not removed to minimize disruption of intraocular anatomy at the time of primary globe repair. The anterior chamber was then reformed with cohesive ophthalmic viscoelastic device. The full thickness corneal laceration repaired with 11 interrupted 10-0 nylon sutures with knots buried. Gentle irrigation and aspiration were then performed to remove the remaining viscoelastic gel after confirming that there was no iris incarceration, and the wound was finally tested for leak and was confirmed to be watertight.

On the first post-operative day, vision was hand-motion with good light projection. Except for the development of a dense white cataract, the rest of the post-operative course was unremarkable. It was confirmed that there was no elevated intraocular pressure, anterior chamber reaction, fibrin, or other signs of inflammation. Ultrasound examination was performed during the follow up course and showed attached retina up to 6 months post trauma. The patient's vision remained stable at post-operative month six. Corneal sutures are now being removed sequentially and the patient is expected to undergo cataract extraction after total suture removal.

3. Discussion

The first two cases of penetrating globe injuries to rear-view side-mirrors were published in 1990.[6] Both cases resulted from oncoming traffic striking the driver's side rear-view side mirrors leading to full thickness corneal lacerations.

In a subsequent series, 3 Australian patients with globe injuries from isolated rear-view side-mirror glass fragments were described in 1998.[7] All three patients sustained penetrating globe injuries with corneal lacerations from broken glass fragments from the rear-view side-mirror leading to globe penetration that required surgical treatment. The authors stated that the Australian Design Rule 14/02 had standards regarding mounting, positional, and optical specifications but no regulations regarding mirror construction and glass material.[7]

Two other cases were later published from the United Kingdom in 2004 with penetrating globe injuries.[8] Both of these cases were injuries due to isolated rear-view side-mirror glass fragments. According to the European Community Directive guidelines, all mirrors used in vehicles must undergo a 7 kg pendulum impact test and that any broken mirror fragments larger than 2.4mm should remain adherent to the protective housing.[8] However, the authors pointed out that even small fragments can cause significant injuries at high velocities during motor vehicle crashes.[8]

Rear-view side-mirror induced penetrating and non-penetrating ocular injuries have also been documented in the U.S. A recent retrospective review published in 2019 reported 3 cases of similar globe injuries from a single U.S. institution within just a 3-month time period.[9] All three patients suffered from large corneal and/or scleral lacerations accompanied with significant intraocular damage. Another earlier retrospective review reported 41 patients with ocular or periocular injuries due to rear-view side-mirrors including eyelid/brow lacerations, corneal abrasions, corneal/scleral lacerations, and globe contusion.[10] While glass-related serious ocular injuries secondary to side-mirror are rare, they are a source of significant morbidity that are likely to be under-recognized. Thompson et al. postulated that rear-view side-mirror injuries may be under-recognized in major MVCs and are often attributed to shattered windshields.[7] Our case, like the previously discussed case reports, are clear incidents of injury due to isolated damage to the rear-view side-mirror without associated damage to the windshields, side windows or interior rearview mirrors.[6–9]

Our review of literature points to a need for better safety measures for of vehicle mirror material in preventing injury in Australia, the U.K., and the U.S. Currently, the Federal Motor Vehicle Safety Standards in the United States have no specifications for glass material composition or durability for rear-view side-mirrors. The emergence of these cases shows a potential area of injury prevention that could be addressed with improved policies and regulation of glass materials used for vehicle mirrors.

4. Conclusion

Traffic injuries account for a large proportion of injuries in the United States and globally given the ubiquity of motorized vehicle use today. Despite on-going efforts to reduce morbidity and mortality through various regulatory efforts, potential harm caused by rear-view side-mirrors has not been scrutinized. Our case of severe ocular injury caused by rear-view side-mirror and those previously reported highlight an area of opportunity for injury prevention.

Patient consent

Consent to publish the case report was not obtained. This report does not contain any personal information that could lead to the identification of the patient.

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Authorship

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

Declaration of competing interest

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