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Resolution of traumatic mydriasis and accommodative dysfunction eight years after sweetgum ball ocular injury

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ABSTRACT

Purpose: To present a case of traumatic mydriasis (MD) and accommodative dysfunction (AD) secondary to a sweetgum ball ocular injury that resolved 8 years after the inciting trauma.
Observations: A 6-year-old female presented with left eye ocular trauma after being hit with a sweetgum ball. Sweetgum balls are the small, spiky fallen fruits of the American Sweetgum tree (*Liquidambar styraciflua*). Due to their size and shape, children often use them as projectiles during play. On presentation, the patient had a partial thickness corneal laceration, traumatic mydriasis (TM), and accommodative dysfunction (AD). Her corneal laceration was repaired. Her TM and AD persisted. She was treated with bifocal spectacles and patching. At her 7-year follow-up visit, her TM and AD showed minimal signs of improvement. Eight years post-injury, her TM and AD had both improved significantly.
Conclusion and Importance: Sweetgum balls, when used as projectiles, pose a risk of serious ocular injury. Pupillary and accommodative function in TM may improve much later than previously appreciated. Young age may contribute to parasympathetic neuroregeneration. Patching may have prevented amblyopia in this case, allowing her left eye to achieve its full visual potential once her pupillary and accommodative function returned.

1. Introduction

Traumatic mydriasis (TM) is caused by damage to the sphincter pupillae muscle, often with concomitant iris tears and irregular pupil shape.[1] The degree of anisocoria varies and depends on the amount of muscle damage; it is more easily demonstrated in bright illumination.[1] TM has been known to occur in the pediatric population after trauma with projectiles, such as from airsoft guns.[2–4] Accommodation loss can be associated with traumatic mydriasis, and patients often complain of blurred vision, eye pain, and photophobia.[1] While sometimes permanent,[5] these cases may resolve within months.[3,6,7] We present a case of TM with loss of accommodation secondary to an injury with a sweetgum ball that resolved between seven and eight years after the inciting traumatic event.

Case Report

A 6-year-old female presented at Wills Eye Hospital complaining of persistent left eye pain, blurred vision, and photophobia in her left eye (OS) two days after being hit with a sweetgum ball. She was initially diagnosed with a corneal abrasion by another ophthalmologist. Past ocular history included resolved retinopathy of prematurity and accommodative esotropia. She did not have a history of amblyopia. Her best corrected visual acuity (BCVA) was 20/20 right eye (OD) and 20/50 OS. Slit lamp and dilated fundus examinations revealed a partial thickness corneal laceration with retained plant material, iris tears at 4, 6, 11, and 12 o'clock, and commotio retinae in the inferotemporal midperiphery OS. Her pupil was pharmacologically dilated by the prior ophthalmologist.

She underwent surgical irrigation of the wound, foreign body removal, cultures, and laceration repair with sutures. Postoperative loteprednol 0.5% drops OS were tapered over nine months, in an effort to minimize the corneal scar. She did not receive medical or surgical treatment for her mydriasis in order to allow for light passage around the corneal scar OS. At each follow-up visit, the patient was assessed clinically, measured with near card assessment, and refracted. Four months later, her BCVA OS remained 20/50 and J7-with an irregular paracentral corneal scar, anisocoria with multiple iris sphincter tears, and accommodation dysfunction OS. Pupillary reactivity OS was absent. Pupillary diameter in room light was 4mm OD and 7mm OS. There was no afferent

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pupillary defect. Near refraction of +2.50 improved near vision OS to J2+. Patching therapy OD 2 h daily and glasses with a left unilateral bifocal were started. The patient continued patching therapy for 3 years and bifocal use for 7 years without significant change in her examination. Clinic notes indicate the persistence of iris tears. Seven years after the inciting injury, her BCVA remained 20/50 secondary to the paracentral corneal scar and irregular astigmatism, but her mother had noticed improvement in the anisocoria. The left pupil was more reactive and symmetric. There was no improvement in accommodation. At the 8-year post-injury visit, her pupils were briskly reactive and near vision without the bifocal was J1+ at 33 cm in each eye individually. Her bifocal was removed (Fig. 1). Her pupillary diameters in room light were 3.5mm OD and 4mm OS. Corneal topography (Orbscan II, Bausch and Lomb, Rochester, NY) on both eyes 8 years after the injury revealed a normal corneal curvature OD and moderate irregular astigmatism due to the corneal scar OS (Fig. 2).

Informed consent to publish this case report was obtained from the patient's mother.

2. Discussion

This case is unique in two aspects: the sweetgum ball mechanism of injury and the delayed but complete recovery of pupillary and accommodative function. After a MEDLINE and PubMed literature search, we are unaware of any similar reported cases. We could not find any reports of sweetgum ball ocular injuries. Injuries related to projectiles have been noted to cause hyphema, corneal edema, corneal erosions, traumatic mydriasis, traumatic cataracts, and commotio retinae.[2–4] The spikes from the sweetgum ball likely caused the patient's corneal laceration, and the force of the blunt impact may have caused the damage to her sphincter pupillae and her commotio retinae. The spikes of the sweetgum ball may cause different impact damage than a smooth sphere. Also, it is possible that the sweetgum ball may have transferred the damage more posteriorly if the patient exhibited a Bell's phenomenon at the time of impact.

Both traumatic mydriasis and accommodation loss have been reported as long-term findings following a projectile injury.[2–4] However, there is limited published data regarding healing times or final outcomes. TM typically resolves in the weeks following the injury or is permanent.[7,8] One study found that 14 of 35 eyes with TM and angle recession returned to normal size by 4 months.[9] Another study found that TM is permanent in about 2% of cases.[5] Although our patient's distance acuity remained limited by the paracentral corneal scar and irregular astigmatism, her anisocoria, pupil reactivity, and near acuity all improved eight years after the inciting injury.

Stillwater and Levine reported a case of TM resolving four weeks after an orbital floor fracture.[10] The neuropraxia was thought to involve trauma to the ciliary ganglion, short ciliary nerves, or parasympathetic motor root.[10] Our patient may have suffered a mixed mechanism of direct damage to the sphincter pupillae with concurrent parasympathetic nerve injury.[5,7,10] Her commotio retinae indicates more posterior trauma that may have damaged her short ciliary nerves,[10] likely from blunt force of the impact.

There is no previous literature supporting amblyopia therapy for accommodation loss or TM. We speculate that the patient's exceptional treatment adherence may have prevented loss of vision due to

Fig. 1. Photos shared by the patient's mother at: (A) 1 year after injury, (B) 2 years after injury, (C) significant improvement 8 years after injury.

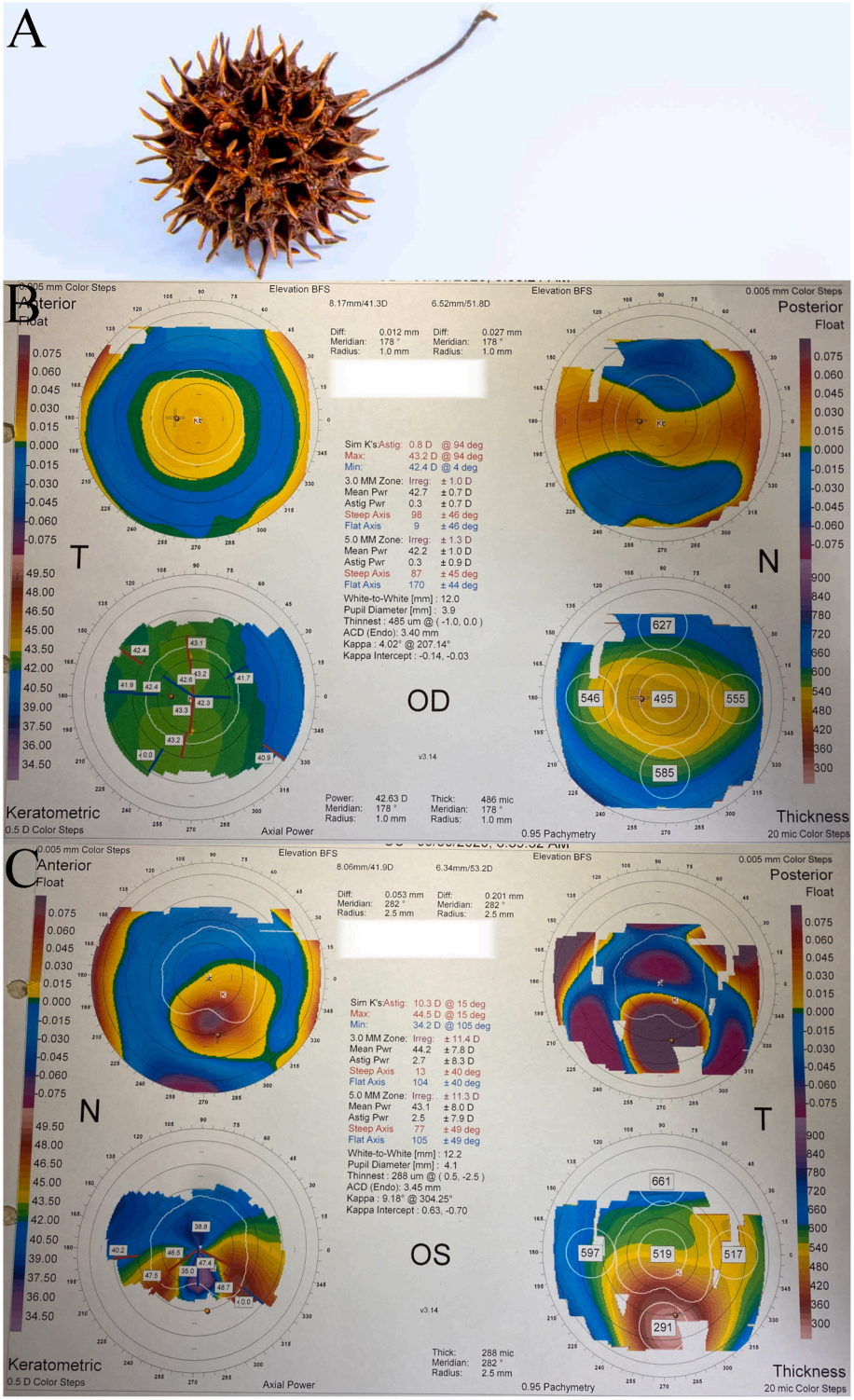

Fig. 2. (A) Photograph of Sweetgum ball (*Liquidambar styraciflua*). (B) Orbscan II (Bausch & Lomb, Rochester, NY) obtained seven years after the injury demonstrating normal corneal topography of the right eye. (C) Same Orbscan II (Bausch & Lomb, Rochester, NY) corneal topography of left eye revealing moderate irregular astigmatism directly related to the paracentral corneal scar.

amblyopia secondary to the corneal scar and loss of accommodation. The patient and her mother were both highly motivated and compliant with patching and spectacle correction. At minimum, the patching perhaps inhibited amblyopia, protecting the visual function in her damaged eye until her pupillary and accommodative dysfunction improved. Her young age may have contributed to parasympathetic neuroregeneration.

3. Conclusions

Sweetgum balls, when used as projectiles, pose a risk of serious ocular injury. Pupillary and accommodative function in TM may improve later than previously appreciated. Patching and/or spectacle correction in pediatric ocular trauma patients may be warranted in the amblyogenic age group.

Patient consent

Informed consent was obtained from the patient's mother.

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Authorship

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

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Research ethics

We further confirm that any aspect of the work covered in this manuscript that has involved human patients has been conducted with the ethical approval of all relevant bodies and that such approvals are acknowledged within the manuscript.

IRB approval was obtained (required for studies and series of 3 or more cases)

Written consent to publish potentially identifying information, such as details or the case and photographs, was obtained from the patient(s) or their legal guardian(s).

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Declaration of competing interest

The authors have no competing interests or financial disclosures regarding this study.

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