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American Journal of Ophthalmology Case Reports

journal homepage: <http://www.ajocasereports.com/>

Case report

Persistent pseudomyopia following a whiplash injury in a previously emmetropic woman



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ARTICLE INFO

Article history:

Received 25 January 2017

Received in revised form

4 September 2017

Accepted 21 September 2017

Available online 22 September 2017

Keywords:

Ocular distance accommodation

Pseudomyopia

Reflex

Spasm

Whiplash injury

ABSTRACT

Purpose: Accommodative spasm, which manifests as ciliary muscle spasm, convergent strabismus or miosis, is a recognised consequence of head trauma. In whiplash cases, cervical spine hyperextension poses a risk of contra-coup injury and brainstem trauma, and is known to affect the visual system. However, to date, no cases of accommodative spasm due to whiplash injury have been reported.

Observations: We present the case of a 34-year-old female who developed sudden onset blurred distance vision after a rear impact car crash, having previously been emmetropic. Her unaided distance visual acuity was 20/70 in the right eye and 20/20 in the left. Best-corrected visual acuity in the right eye was 20/20 with a correction that progressed from -1.75 to -3.50 DS over the 12 months following the accident.

This patient's sudden unilateral myopia, with unilaterally increased amplitude of accommodation suggests pseudomyopia due to accommodative spasm. Magnetic resonance imaging showed no evidence of injury to her brain stem, frontal lobes or oculomotor nerve. The patient is now well adjusted with a -3.50 DS corrective lens for the right eye.

Conclusions and importance: The accommodation reflex is susceptible to injury at the occipital lobe, frontal eye fields, Edinger-Westphal nuclei and oculomotor nerves. As such it should be examined in patients who present with visual disturbances following whiplash injury.

It is important that such cases are identified at presentation, as early intervention can improve outcomes in accommodative spasm and reduce the long term psychological effects often associated with whiplash injuries.

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1. Introduction

Accommodative spasm is a rare condition which occurs with excessive parasympathetic stimulation to the eye causing one or more of: pseudomyopia due to ciliary muscle spasm, convergent strabismus or miosis. Patients report a defect primarily in their distance vision as the eye remains in a constant state of accommodation. Associated with this, headaches and eyestrain are often experienced. Measurement of refraction will demonstrate myopia along with normal amplitudes of accommodation.¹

Accommodative spasm as a result of trauma is a recognised phenomenon, with previous cases having been reported due to closed head trauma,² severe traumatic brain injuries³ or direct

trauma to the eye. While many cases will resolve spontaneously within a matter of months, severe cases can persist.⁴

Whiplash associated disorders arise from a mechanism of injury typical in rear impact motor collisions; whereby the cervical spine is suddenly hyperextended and subsequently rapidly hyperflexed in a motion driven by the sudden forward acceleration of the torso. These movements pose a risk of contra-coup injury to the frontal lobe, which contains the frontal eye fields.⁵ In addition, a range of brainstem traumas have been described as a result of the hyperextension injuries seen in whiplash; these include lesions to the abducens and vestibulocochlear nuclei, located in the pons, and paramedian midbrain syndrome, which is an oculomotor nerve palsy.⁶

To our knowledge, accommodative spasm associated with whiplash has not previously been reported.

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2. Case report

Here we describe the case of a 34-year-old female who presented to our institution 12 months after a whiplash injury sustained when her car was hit from behind at speed. While the airbags did not deploy, the patient sustained no direct facial or ocular injuries. She described blurred distance vision without diplopia, which began immediately after the accident occurred, and she was prescribed a right sided -1.75 dioptres sphere (DS) corrective lens shortly after the accident. On examination at our clinic, her unaided distance visual acuity (UDVA) was 20/70 in the right eye and 20/20 in the left. Best-corrected visual acuity (BCVA) in the right eye was 20/20 with a correction that had progressed to -3.50 DS since her initial refraction following the trauma. Two drops of 1% w/v atropine sulphate administered into the patient's right eye provided immediate relief of the patient's visual symptoms. However this effect was not sustained and the medication was not well tolerated. Anterior and posterior segment examination showed no abnormalities and extraocular movements were normal. The patient had previously been refracted when vision was tested for her driving license and had been found to be emmetropic with equal visual acuity in both eyes 15 years prior to the motor traffic accident.

Her accommodative amplitude, measured by push up testing, was 10 DS in the right eye and 8 DS in the left, with accommodation being sluggish in the right eye. With a -3.50 DS lens in place, her amplitude of accommodation was 8 DS with ease bilaterally. Her near point of convergence with an accommodative target was 6cm, and normal pupillary constriction was observed on accommodative testing. Pupillary light reflexes were normal.

This patient's sudden onset of progressive unilateral myopia, with unilaterally increased amplitude of accommodation represents a pseudomyopia due to the accommodative excess of accommodative spasm.⁷ Magnetic resonance imaging of this patient's brain and brainstem showed no radiological evidence of injury to her brain stem, frontal lobes or to the path of the oculomotor nerve. A detailed slit lamp exam was undertaken at presentation, which ruled out cataract, lens dislocation, subluxation and phacodonesis. The patient was prescribed a -3.50 DS corrective lens in the right eye which has addressed her symptoms.

3. Discussion

The pathway of the accommodation reflex encompasses many elements of neuroanatomy distributed throughout the cranium, making the system susceptible to injury. Afferent signals received from the optic nerve via the lateral geniculate nucleus of the thalamus are integrated in the visual association cortex at the posterior of the occipital lobe. Efferent control of accommodation begins in the frontal eye fields; here there is a risk of irritative lesioning through contra coup injury.⁸ These efferent fibres first synapse to leave the brainstem at the Edinger-Westphal nuclei. These paired preganglionic nuclei are the most rostral and superior parasympathetic nuclei in the brainstem; they are located at the superior colliculi, just anterior to the cerebral aqueduct. Crucially, they are located immediately posterior to the oculomotor nuclei, such that mild trauma to the posterior of the midbrain could injure the Edinger-Westphal nuclei independently of the oculomotor nuclei.

General visceral efferent fibres in the inferior division of the oculomotor nerve, split to give off the parasympathetic motor root to the ciliary ganglion, immediately anterior to the superior orbital fissure. During its course to the ciliary ganglion the oculomotor

nerve is at risk of compression as it passes the posterior crinoid process of the sphenoid bone.⁹ Both the ciliary ganglion and short ciliary nerve are also susceptible to indirect injury.

Whiplash has been known to affect the visual system, with cases reported of decreased accommodation, superior oblique muscle paresis, decreased stereoacuity, vitreous detachments, and the underdiagnosed whiplash maculopathy.^{10,11} However, no reports were found that describe the development of pseudomyopia following a whiplash type injury, making this a unique example of whiplash as an aetiology for organic accommodative spasm. This diagnosis is distinct from spasm of the near reflex which typically mimics an abduction deficit with recurrent diplopia, as attempts at lateral gaze trigger a concomitant convergence with miosis.¹²

4. Conclusion

The effect of whiplash injuries on the visual system can be distressing for patients. It is important that accommodative spasm cases such as this are identified at presentation, as early intervention can improve outcomes in accommodative spasm and could reduce the long term psychological effects often associated with whiplash injuries.

Funding

No funding or grant support.

Conflict of interest

The following authors have no financial disclosures: FEH, MPT, ESD, PBM.

Authorship

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

Patient consent

The patient consented to the publication of this case in writing, with the assurance given that no personal information was included, and that they would not be identifiable.

Acknowledgements

None.

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