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Saccadic intrusions in paediatric concussion

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Abstract

Three paediatric patients post-mild traumatic brain injury (mTBI, also known as concussion) developed saccadic intrusions, which are irregular, involuntary saccades that interrupt fixation. Each patient presented to a mTBI clinic months post-injury, complaining of headaches, difficulty concentrating, and dizziness. Written informed consent from parents was obtained for use of these cases.

Keywords

concussion; paediatrics; saccades; vision therapy

Patient 1

Patient 1 is a 14-year-old Caucasian male who was injured during work. On initial visit to the clinic two months post-injury, the patient reported daily headaches and difficulty concentrating. His headache increased when reading and taking notes in school.

This patient was seen again five months post-injury. Examination revealed saccadic intrusions during smooth pursuit. The patient was referred to an optometry clinic where saccadic intrusions were confirmed (Figure 1). Vision therapy was commenced and 100 mg gabapentin was prescribed for the saccadic intrusions.¹ On follow-up two months after gabapentin, saccadic intrusions were present although diminished. The patient reported decreased headache and longer periods of asymptomatic reading. He did not return for post-treatment eye-tracking.

Patient 2

Patient 2 is a 10-year-old Caucasian female who sustained a mTBI on the playground. Immediately after injury she reported dizziness, headache, and blurred vision.

At her initial visit one month post-injury, the patient reported headache and dizziness, and saccadic intrusions were noted on examination. She was referred to the optometry clinic for vision therapy and for confirmation of saccadic intrusions (Figure 2) and was started on 100 mg gabapentin.

One month later, the patient had lower symptom exacerbation. She returned to the optometry clinic where her saccadic intrusions had objectively diminished (Figure 3).

Patient 3

Patient 3 is a 15-year-old African-American female who sustained a mTBI during soccer. Immediately after injury she reported dizziness, confusion, visual changes, difficulty concentrating, and memory problems. Patient 3 presented to the mTBI clinic one month post-injury with no evidence of saccadic intrusions.

Two months later, the patient reported continued difficulty focusing in school, but reported diminished headache severity. Examination now showed saccadic intrusions, which were confirmed through eye-tracking (Figure 4). She was prescribed gabapentin 100 mg and one month later reported the medication led to an improvement of her headache and trouble concentrating in class, but not for post-treatment eye-tracking.

Discussion

These patients showed saccadic intrusions during smooth pursuit but not during fixation, contrasting with saccadic intrusions seen in other diseases.² In addition, their lack of other oculomotor findings, such as ophthalmoplegias, spontaneous nystagmus, or impaired vestibulo-ocular reflex, suggest a lack of brainstem involvement.³ mTBI has commonly been associated with oculomotor changes, such as increased saccadic latencies and impaired convergence, but this is believed to be the first exploration of saccadic intrusions in mTBI.^{4,5}

Identification of saccadic intrusions here underscores the importance of robust, comprehensive oculomotor testing for mTBI. It is likely saccadic intrusions were responsible for the headaches suffered by these patients while reading, as they can cause visual disturbances such as oscillopsia and double vision.⁶ Especially in paediatric populations, it is essential to understand what may be causing academic difficulties.

These positive outcomes with administration of gabapentin and vision therapy indicate there may be ways to intervene. Future studies in these patients should investigate which therapies are most efficacious.

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Figure 1.

Patient 1, 0.2 Hz horizontal smooth pursuit trace. Black line is the location of the target (UP/ Increase in degree = Rightward, DOWN/Decrease in degree = Left-ward). Blue trace is the eye fixation location of the patient.

Figure 2.
Patient 2, 0.1 Hz horizontal smooth pursuit trace before gabapentin treatment

Figure 3. Patient 2, 0.1 Hz horizontal smooth pursuit trace after two months of gabapentin. Notice that the trace is still not entirely smooth but is more accurate and with smaller amplitude deviations than before gabapentin in Figure 2.

Figure 4. Patient 3, 0.1 Hz horizontal smooth pursuit trace (UP/Increase in degree = Upward, DOWN/Decrease in degree = Downward). Notice that there are fewer deviations of greater amplitude than the traces of Patients 1 and 2.