Bilateral Abduction Deficits in Idiopathic Intracranial Hypertension and Improvement with Acetazolamide Treatment: An Infrared Oculography Study
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Introduction
Idiopathic intracranial hypertension (IIH), also known as pseudotumor cerebri, is a syndrome of elevated intracranial pressure (ICP) without clinical, laboratory, or radiographic evidence of intracranial etiology. The typical patient is an overweight woman of childbearing age who is otherwise healthy with symptoms of headache, pulsatile tinnitus, vision loss and, less commonly, diplopia. In this study, we recorded reflexive saccades to determine if this test is an effective outcome measure for disease and response to acetazolamide treatment.

Methods
We recorded 25 consecutive patients referred for evaluation of IIH with 500-Hz binocular infrared oculography. Clinical assessment included ocular alignment with single Maddox rod and standard gaze positions. Eighteen patients fulfilled the Modified Dandy criteria for IIH, and data from 16 patients with good recordings (10 paired recordings performed before and on acetazolamide) were analyzed. Stimuli included reflexive centrifugal saccades. Each eye was calibrated independently, and data were analyzed with MATLAB and IgorPro.

Results

1. While 19% of patients with IIH reported binocular diplopia at presentation, 90% exhibited subtle bilateral abduction deficits during reflexive horizontal saccades. There was no inter-ocular mismatch during vertical saccades.

2. Treatment with acetazolamide normalized inter-ocular horizontal mismatch. Left: paired pre- and on-treatment recordings showed significant improvement of both the rightward (n = 10 pairs, P = 0.03) and leftward saccades (n = 10 pairs, P = 0.02).

3. 72% of patients with IIH exhibited small esophoria before treatment, compared to 33% after treatment.

Table 1. Clinical assessments. Body mass index ≥ 30: obese. Values listed as mean ± standard deviation.

Table: Sex: Women: 15/16 (94%) n = 15; Men: 1/16 (6%) n = 1
Age: 40 ± 3.2 n = 16
Body Mass Index: 35 ± 1.9 n = 16
Visual Acuity: OD 20/20: 16/100% n = 16; OS 20/20: 16/100% n = 16
Visual Field: Foveal Sensitivity: OD: 35 ± 2.4 n = 12; OS: 36 ± 1.7 n = 12
Mean Deviation: OD: -2.3 ± 1.8 n = 13; OS: -0.9 ± 2.9 n = 13
Papillodema: Frisen Grade ≤ 1: 10/16 (62%) n = 16; Frisen Grade ≥ 2: 6/16 (38%) n = 16

Fig. 1. Acetazolamide treatment improved ocular alignment. Before treatment, 72% of patients exhibited esophoria, compared to 33% on acetazolamide (n = 7 pre- and n = 12 post-treatment).

Fig. 2. Exemplar of abduction deficit during rightward saccades before and on acetazolamide. This pattern of abnormality was similar to that of cranial nerve VI palsy. VelOD: velocity, right eye; VelOS: velocity, left eye.

Fig. 3. Treatment with acetazolamide (1000-2000 mg per day) rapidly improved abduction deficits bilaterally. Left: paired pre- and on-treatment recordings showed significant improvement of both the rightward (n = 10 pairs, P = 0.03) and leftward saccades (n = 10 pairs, P = 0.02). Middle: Unpaired, population data showing the average amplitude for paired (n = 10) and all (n = 12 pre- and n = 14 post-treatment) recordings between the abducting and adducting eyes. Right: binocular saccade mismatch before and during treatment. OD: right eye, OS: left eye.

Conclusions
1. While 19% of patients with IIH reported binocular diplopia at presentation, 90% exhibited subtle bilateral abduction deficits during reflexive horizontal saccades. There was no inter-ocular mismatch during vertical saccades.

2. Treatment with acetazolamide normalized inter-ocular horizontal mismatch.

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References