Title:
Binasal Occlusion as a Method to Improve Visual Symptoms in a Traumatic Brain Injury (TBI) Patient

Abstract:
A TBI patient with symptoms of blurred vision, vertigo, and dizziness improves with visual vestibular rehabilitation and binasal occlusion. Visual evoked potential (VEP) shows greater amplitude of visual information processed with binasal occlusion than without.

I. Case History
- Patient demographics: 62 year old Caucasian male.
- Chief complaint: Blurred vision secondary to head injury and vertigo. Periodic headaches, dizziness, and balance dysfunction. Impaired memory and decreased cognition. No diplopia reported.
- Ocular, medical history:
  - Glasses wear only for driving, LEE 2 years ago
  - PT note: headaches with cervical pain, decreased mobility and motor function, dizziness, nausea, fatigue, imbalance, possible cranial nerve issues, and decreased concentration.
- Medications: Excedrin, oxycodone as needed.

II. Pertinent findings
- Clinical:
  - VA 20/50 OD, 20/30 OS, 20/25 OD, 20/25 OS @D
  - OD +1.75-0.75x75 BCVA 20/20, OS +0.75-0.25x102 BCVA 20/20
  - Add +2.00 BCVA OU 20/20 @N
  - Dynamic visual acuity sc 20/25
  - Pupil size equal in light (4.5mm) and dark (6.5mm) OU, round and reactive to light, no APD
  - Palpebral fissure OD 9mm, OS 7mm, mild ptosis OS
  - CTsc ortho at D, 6PD EP at N
  - Shaky fixation, unable to fix and follow smoothly with both eyes
  - Fusional BI ranges low at distance
  - Anterior and posterior segment unremarkable
- Physical:
  - Vertigo symptoms, happens periodically with no pattern noted
Dizziness when maneuvering up and down, and when shifting gaze
- Cranial nerves function within normal limits
- Radiology studies: CT showed mild chronic microvascular ischemic changes throughout white matter. No indication of Horner’s syndrome. MRI unremarkable.
- Others
  - Neurologist: Neurologic examination normal, no ptosis or miosis. Status-post concussion with post concussional symptoms.
  - Physiatrist: Mild closed head injury and post concussion syndrome, benign proximal positional vertigo, focusing and concentration troubles, and difficulty with balance.

III. Differential diagnosis
- Primary/leading:
  - Visual vertigo symptoms secondary to head injury
  - Increased visual motion sensitivity (VMS) creating adverse physiological and perceptual effects
- Others:
  - Peripheral vestibular disorder
  - Dys conjugate gaze
  - Pursuit deficiencies
  - Reduced fusional ranges

IV. Diagnosis and discussion
- Elaborate on the condition:
  - Visual vertigo is defined as dizziness provoked by visual environments with full field repetitive or moving visual patterns. Symptoms include nausea, vertigo, unsteadiness, balance difficulties, disorientation and a sense of visual confusion/chaos. They are usually aggravated by specific visual contexts including supermarkets, and so alternately named “supermarket syndrome”. Dizziness handicap inventory and motion sensitivity quotient can be used as a method to diagnose motion sensitivity. Binocular work up and assessing visual function is useful as well. Treatment may include vision vestibular rehabilitation and binasal occlusion.
- Expound on unique features:
  - Binasal occlusion has been used clinically to reduce VMS, particularly in TBI patients. It has been speculated that TBI patients attempt to suppress information in the near retinal periphery to reduce VMS. This increases the motion processing load and the patient has difficulty maintaining comfortable viewing. Binasal occlusion reduces the amount of overlap of central binocular fields and suppression is now rendered unnecessary.
enhanced central field responsivity leads to increased amplitudes in VEP measurements.

V. Treatment, management

- Treatment and response to treatment:
  - Binasal occlusion:
    - VEP: increased amplitude of visual information processed with binasals (14.08uV in high contrast and 15.10uV in low contrast) compared to without binasals (13.15uV in high contrast and 8.45uV in low contrast)
  - Visual vestibular rehabilitation:
    - Visual guidance activities including blinking to decrease motion during saccades and pursuits. Increasing ocular fixations while scanning to stabilize peripheral motion.
    - Bean bag activities: increase vestibular stimulus that drives visual response and to facilitate visual-vestibular integration
    - Dolls eye: increase head movement with vestibular input to improve accuracy of fixation
    - Rotations: increase lateral tracking with increased ab- and adduction motor stimuli
  - Peripheral awareness tasks:
    - Hart Chart, GTVT chart: increase peripheral awareness and increase central visual field

- Response: Patient reported increase comfort and significantly reduced VMS. Patient is now able to complete activities of daily living (ADL) with reduced symptoms. Patient reports less dizziness, vertigo and headaches. Patient also notes an increase in motility and motor function.

- References:

VI. Conclusion
Clinical pearls:
  - Binasal occlusion may be a good treatment for patients with visual motion based dizziness, vertigo symptoms, and TBI patients with related visual symptoms.