Neuro-Optometric Rehabilitation of Visual Sequelae Following Surgical Correction of Vertical Dystopia

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Abstract:

Surgical correction of orbital dystopia can result in constant diplopia secondary to orbital misalignment. This poster presents a case in which the patient manifests co-morbid visual vestibular symptoms and the unique role of neuro-optometric rehabilitative therapy.

1. Case History
   - Patient demographics:
     - 21-year-old Hispanic female
     - History of orbital dystopia secondary to congenital craniofacial abnormalities
   - Chief complaint:
     - Uncorrected distance visual blur OU
     - Monocular diplopia OD at distance and near
     - Binocular vertical diplopia at distance and near
     - Difficulty with moving her eyes
       - Makes compensatory head movements to the right and left
     - Dizziness and difficulty with motor coordination
       - Feels off balance
       - Often leans towards one side and finds walking straight difficult
       - Dizziness alleviated with closing her eyes
     - Non-localized headaches with no associating factors
     - Unable to perform near work for any length of time secondary to fatigue and eye strain
   - Ocular, medical history
     - Congenital facial asymmetry, facial scoliosis, occlusion plane deviation, orbital dystopia
     - Reports diplopia was not present pre-operatively
     - Surgical history, which occurred in May 2016
       - Bifrontal craniotomy
       - Cranialization of frontal sinus
       - Repair of skull base
       - Orbital roof osteomies:
         - Right orbital box osteomy
         - Left sagittal split osteomy
         - Le Fort osteotomy
       - Placement of bone graft
       - Right lateral canthroplasty
       - Right tarsorrhaphy
       - Intermaxillary fixation
       - Fabrication of intraoral splint
• Current medications:
  o Advil, as needed, for pain relief

2. Pertinent findings:
   • Uncorrected distance visual acuities: 20/30- OD, 20/25 OS
   • Refractive analysis: plano-1.00x180 OD, OS
   • Corrected distance visual acuities: 20/20 OD, 20/20 OS
   • Saccades: grade 3, sluggish with undershoot in all gazes, motor overflow with upper eyelids and brows, subjective visual discomfort
   • Pursuits: pain on all right gazes and on upgaze, mild abduction deficit and adduction deficit OD
   • Distance posture (measured with Von Graefe): 1 esophoria, 2.5 right hypertropia
   • Near posture (measured with Von Graefe): 3 esophoria, 3 right hypertropia
   • Near point of convergence without vertical prism: 10-inch break, 20-inch recovery (red lens)
   • Testing with introduction of vertical prism OD:
     o Near point of convergence with 2BD OD vertical prism: 4-inch break, 7-inch recovery (red lens)
     o Motor fields with 2 BD OD prism at distance and 4BD OD prism at near:
       ▪ Right hyper: down and left gaze> right gaze
       ▪ Eso diplopia: up and right gaze> right gaze> down and right gaze
       ▪ Largest problems with fusion in right upgaze
       ▪ Fusion in all other gazes
     o Clown Vectogram ranges with 2 BD prism OD:
       ▪ BO: x/>18 with appropriate localization
       ▪ BI: x/>0 with appropriate localization

3. Differential diagnosis
   • Actual diagnosis: right hypertropia following correction of orbital dystopia
   • Decompensated hyperphoria
   • Orbital floor fracture with extra-ocular muscle entrapment
   • Superior oblique palsy

4. Diagnosis and discussion:
   • Following surgery to correct her orbital dystopia, this patient manifested:
     o Right hypertropia
     o Mild abduction and adduction deficit OD
     o Visually-related dizziness and imbalance
   • Definitions and etiology:
     o Orbital dystopia is defined as “inequalities in the horizontal position of the whole orbit.”
     o 62% of vertical orbital dystopia is caused by congenital malformations, 26% by traumatic events and 12% by neoplasm, fibrous dysplasia, and Romberg’s disease.
According to the literature, “uncorrected vertical displacement of one or both eyes produces more obvious discordant asymmetry of the face and a greater sense of deformity than similar amounts of horizontal deformity.”

- As such, treatment is often strictly cosmetic and undergone to avoid or abate psychosocial distress.

- **Surgical correction:**
  - Subcranial camouflage procedure: for minor vertical deviations
  - Transcranial orbital translocation: for more severe vertical deviations

- **Obstacles with surgical correction:**
  - The margin for surgical error, in terms of millimeters, is considerably less (1/10) than it is for the correction of horizontal displacement. Surgical errors of vertical positioning often produce postoperative visual disturbances more commonly than an error made in the horizontal or rotational axes.

- **Clinical findings normally associated with orbital dystopia pre and post-surgically:**
  - Amblyopia
  - Absence of binocular vision
  - Diplopia
  - Commonly adopt altered head posture to minimize diplopia symptoms
  - Strabismus
  - Restricted ocular motilities
  - To our knowledge, visual-vestibular issues have not been probed postsurgically in these patients.

- **Typical management of visual symptoms post-surgically:**
  - Secondary surgical procedure to correct any further misalignment
  - Strabismus surgery
  - Patching to alleviate diplopia
  - Vertical prism

5. **Treatment, management of our patient:**

- **Spectacle correction:** Our patient was prescribed plano-1.00x180 OD, OS, which alleviated her complaints of monocular diplopia. Maximum visual input to both eyes is critical, as this allows for the best possibility of binocular vision and fusion.

- **Vertical prism:** Vertical prism was prescribed to correct for the right hypertropia that manifested post-surgically. The introduction of prism allowed for binocular fusion in almost all fields of gaze, save that of right upgaze. Additionally, the patient had greater horizontal range of motion and was able to significantly increase her convergence abilities with the introduction of vertical prism. This was demonstrated when assessing motor fields at distance and near, as well as in significant improvement in near point of convergence testing and vectogram.
binocular ranges. The patient was also provided with immediate relief and felt subjectively more balanced with the elimination of her vertical misalignment.

- Selective occlusion: Should the patient continue to experience diplopia in extreme fields of gaze, recent studies have shown the benefits of selective occlusion in non-comitant deviations. Selective occlusion serves as an alternative to patching as a means of eliminating intermittent diplopia. Different from patching, selective occlusion is not only more aesthetically pleasing, but still allows the patient to maintain peripheral fusion and maximum visual acuity in all other fields of gaze.

- Neuro-optometric in-office management: In conjunction with vertical prism, this patient still requires in-office neuro-optometric rehabilitative therapy. This patient’s visual input system is fragile, as she manifests a non-comitant vertical deviation. This fluctuating visual input and retinal slip often results in a mismatch of the VOR (vestibular ocular reflex), and it is this mismatch that leads to the sensation of dizziness and imbalance. Therefore, to address this sense of disequilibrium, this patient would benefit from in-office neuro-optometric rehabilitation. The first phase would enhance ocular motility, including pursuits and saccades. The second phase would focus on increasing and enhancing fusion ranges and stability in order to provide consistent visual input. Once adequate binocular skills are demonstrated, phase III procedures would be utilized in order to improve dynamic fusion. Lastly, therapy would focus on recalibration of the patient’s visual-vestibular integration.

6. Conclusions:

- Interdisciplinary care between the oculoplastic surgeon and the optometrist is imperative for patients who undergo surgical correction for vertical dystopia. While surgical correction may improve cosmesis, post-operatively, patients may suffer from functional visual deficits and associated visual vestibular symptoms.

- Patients with a history of orbital dystopia can present with vertical deviations that can be managed with spectacle correction, vertical prism, selective occlusion and/or neuro-optometric rehabilitative therapy.

- Additionally, patients with a history of orbital dystopia can experience sensory motor symptoms, such as imbalance and dizziness, that can be managed similarly to those with visual-vestibular issues.
References


