Treatment of Visual Midline Shift Syndrome with Yoked Prisms Following a Cerebrovascular Accident to Reduce Risk of Fall

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Bimodal Visual Process

- The visual system is composed of two separate processes. The focal process is related to central visual function and is detail oriented. The ambient process provides general information used for balance, movement, coordination, and posture. It must match information with kinesthetic, proprioceptive, vestibular, and tactile systems forming the sensorimotor feedback loop at the level of the midbrain for the purpose of orienting upright against gravity.
- Following a neurological event such as a Cerebrovascular Accident (CVA), an imbalance between the focal and ambient visual processes causes Visual Midline Shift Syndrome (VMSS). Common characteristics of VMSS include impairments of balance, posture, and head position, thus affecting binocularity. VMSS occurs when the ambient visual process changes its orientation to the proprioceptive base of support following a neurological event.

History and Results

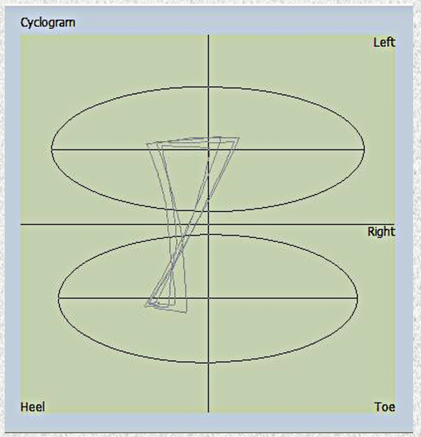
- TD, a 40-year-old male, was referred for a neuro-optometric visual evaluation by a rehabilitation center and presented to clinic 12/10/15. On 10/05/15 he suffered a CVA of the left midbrain and bilateral thalamus. In addition, he reports that he has been "blind" out of his left eye since birth. He currently can't walk independently and is confined to a wheel chair since the CVA. He can only stand with assistance during Physical Therapy. Symptoms: Tunneling of vision, poor balance, blurred vision at near.

Significant Result Findings:

Lensometry: OD: +2.50-1.00 x 013
OS: +2.50-1.00 x 170
VA: Distance cc: 20/20- OD, HM OS
Near: cc: 20/120 OU
Cover Test: 35 pd constant left exotropia at distance and 40 cm
Refraction: OD: +2.25-0.50 x 165 20/20
OS: +2.25-0.50 x 165 HM
Book Retinoscopy: +2.50 – VA improved to 20/25 OU at near.
Visual Midline Shift: Posterior and Right

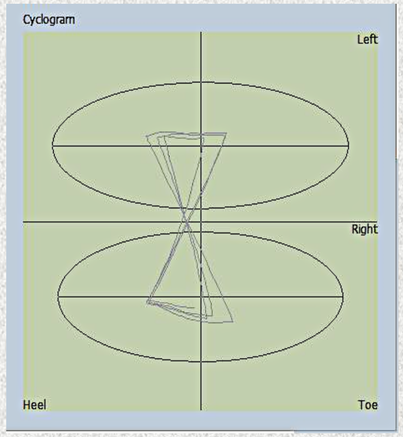
Gait/Balance Analysis- Cyclogram

No Prism



CISP AP	CISP ML
-22.30	-46.40

Yoked Prism: 12 base up and left at 060 degrees



CISP AP	CISP ML
-10.24	0.292

Gait/Balance Results: TD's gait/balance was analyzed using ProtoKinetics Movement Analysis Software during assisted ambulation. CISP-ML and CISP-AP data demonstrate that the center of pressure (CoP) was deviated posterior and right with no prisms which affects center of mass (CoM). Using yoked prism 12 pd base up and left at 060 degrees cyclogram demonstrates equalization with CoP and realignment of CoM.

Diagnosis & Treatment

- TD was diagnosed with Visual Midline Shift Syndrome and Accommodative Paresis following the CVA. Prescribed two pairs of lenses:
  1) Continual wear single vision yoked prism glasses to treat the VMSS
     OD: +2.25-0.50x165 12 base up and in at 060
     OS: +2.25-0.50x165 12 base up and out at 060
  2) FT-35 bifocal to help with intermediate and near vision
     OD: +3.50-0.50 x 165 7 base up and in at 045 with +1.25 add
     OS: +3.50-0.50 x 165 7 base up and in at 135 with +1.25 add

Follow up Visit

- TD had been wearing the yoked prism lenses full time and during physical therapy sessions for 2 months. He reports improvements with balance and stability. This has increased his ability to walk independently. He also reports improvement in reading since using near prism lenses.

Conclusion

- Visual Midline Shift (VMS) is caused by a mismatch between ambient visual processing and the proprioceptive base of support. This compromises postural orientation upright against gravity and weight shift thus increasing risk of fall.
- The VMS causes deviation of center of mass. Yoked prisms are used to realign visual midline affecting center of mass.
- Falls are a public health risk accounting for millions of people seeking medical attention per year. Yoked prims can improve the location of the center of mass over the base of support following a CVA.
- Gait/balance technology can be an effective tool to quantitatively assess the CISP-AP & CISP-ML before and after the use of therapeutic yoked prisms thus giving evidence that yoked prisms can reduce risk of fall following a stroke or traumatic brain injury.

References

1. Eubank T, Ool T. Improving guided action and perception through use prisms. Journal of the American Optometry Association 2001;72:217–226.
2. Padula W, Munitz R, Magrun M. eds. *Neuro-Visual Processing: an Integrated Model of Rehabilitation.* Santa Ana, CA: Optometric Extension Program Press; 2012.
3. Padula W, Nelson C, et.al. *Modifying postural adaptation following a CVA through prismatic shift of visuo-spatial egocenter.* Brain Inj. 2009;23(6):566-576.
4. Padula, W. V., & Argyris, S. Post trauma vision syndrome and visual midline shift syndrome. Neuro Rehabilitation (1996), 6(3), 165-171.
5. Padula W, Subramanian P, Spurling A, Jenness J. Risk of Fall (RoF) intervention by affecting egocenter through gait analysis and yoked Prisms. *Journal of NeuroRehabilitation.* 2015;37(2):305-14
6. Trevarthen C, Two mechanisms of vision in primates. Psychol. Res 1968;31:299-337