Optometry Post-Concussion

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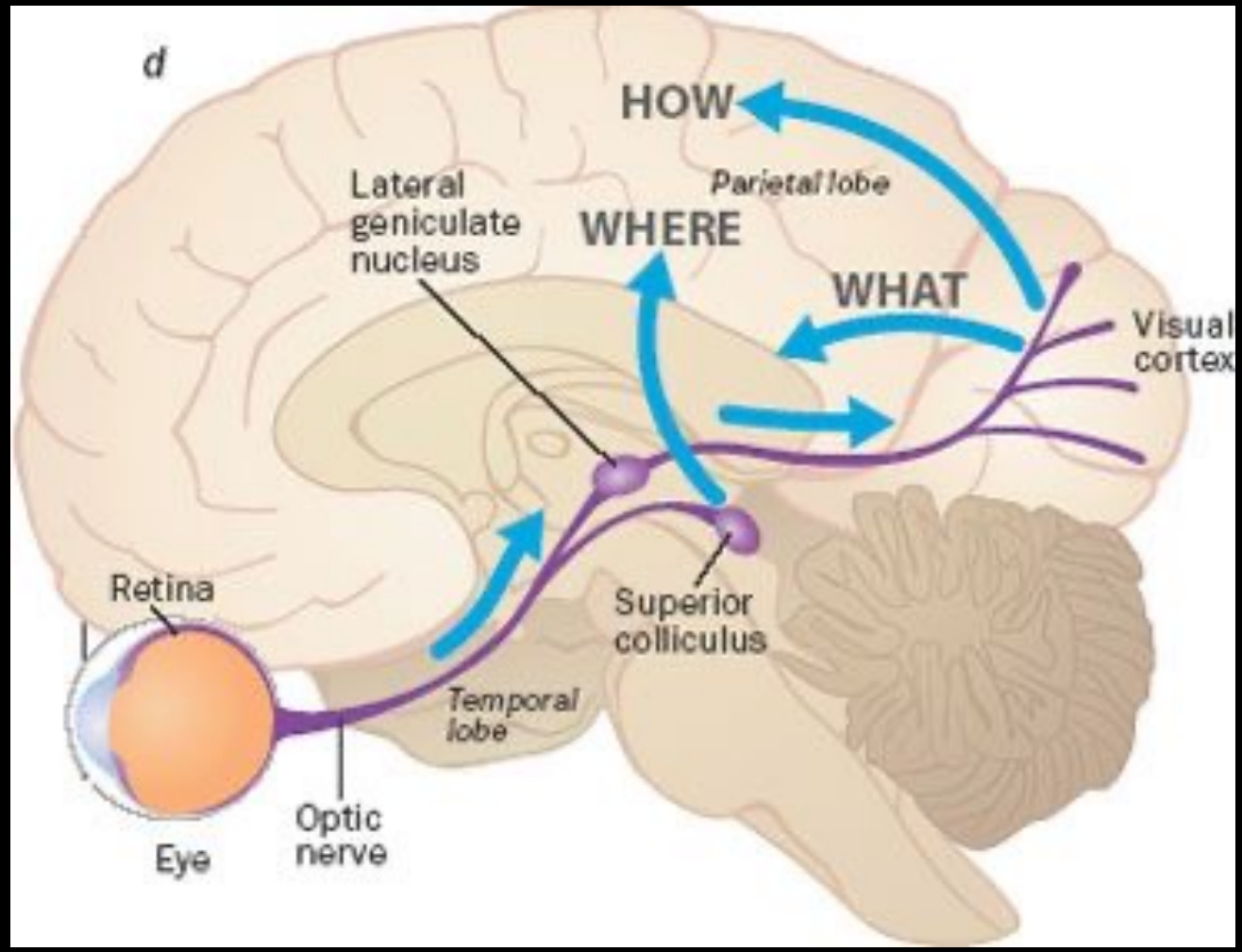
The Visual System



Perceptual System

Optical System

Image: Press LJ. Who, What, Where, and How in the Visual System. The VisionHelp Blog; https://visionhelp.wordpress.com/2018/07/03/who what when where and how in the visual system/

The Vestibular System

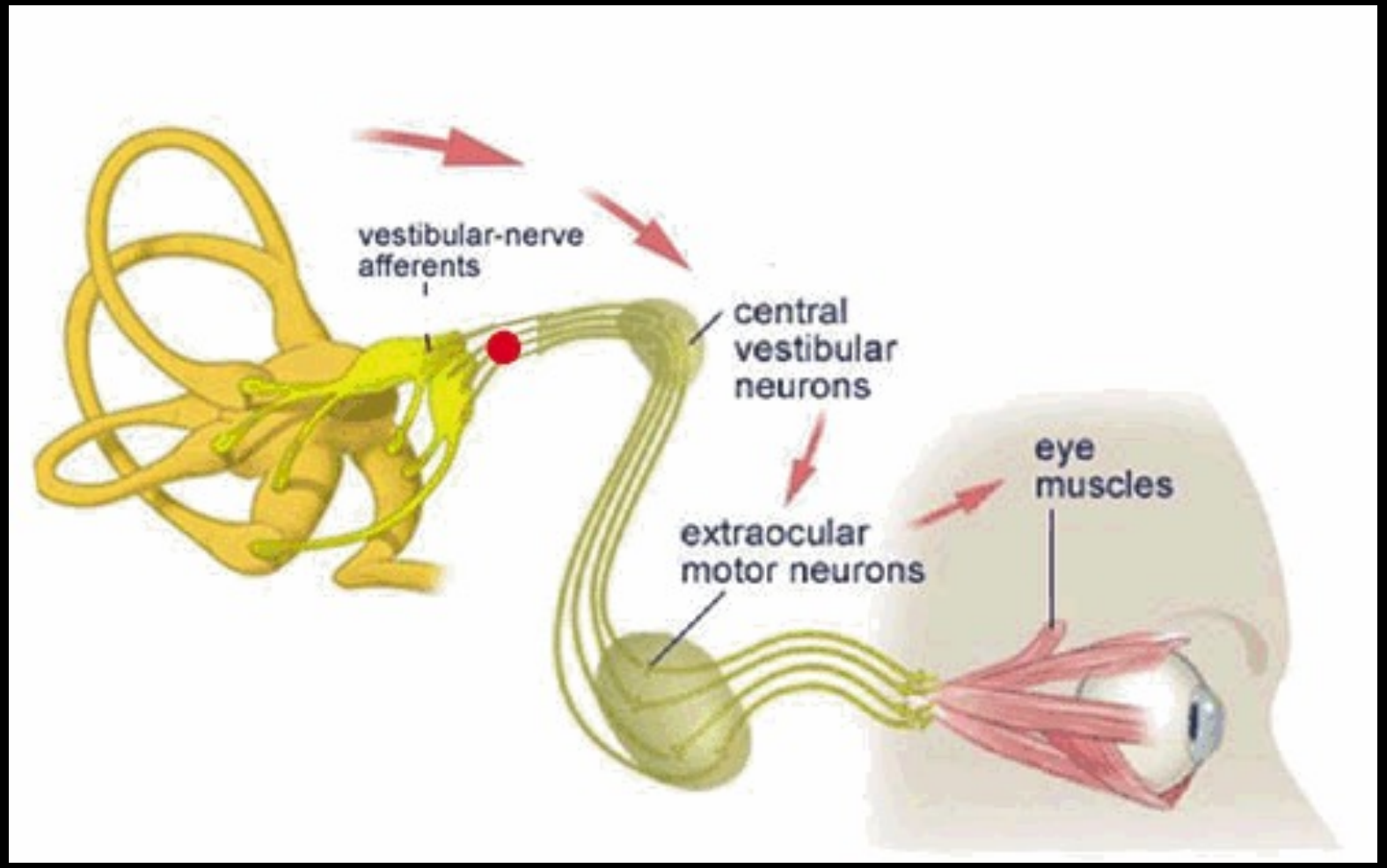


Image: Computational Systems Neuroscience Laboratory, McGill University. Intro to the Vestibular System; https://www.mcgill.ca/vestibular gazecontrol lab/research/intro vestibular system

Headache

Difficulty tracking objects

Trouble reading

Irritability

Nausea

Tinnitus

Poor memory

Dizziness

Trouble focusing

Sensitivity to noise

Sleep disturbances

Balance impairments

Eye strain

Restlessness

Fatigue

Reduced reaction time

Poor coordination

Poor concentration

Light sensitivity

Impaired judgment

Depression

Double vision

Frustration

Blurry vision

Sensitivity to smells

- Up to 90% patients experience vision symptoms after concussion [1-4]

- The presence of vision and vestibular deficits are predictive of prolonged concussion recovery [1]

1. Master CL *et al* (2018) *Clin J Sport Med* 28(2): 139-145
2. Ciuffreda KJ *et al* (2007) *Optometry* 78: 155-161
3. Brahm K *et al.* (2009) *Optom Vis Sci* 86(7): 817-825
4. Goodrich G *et al.* (2013) *Optom Vis Sci* 90(2): 105-112

- **Common vision problems include:**
  - Headaches, focusing issues, reading difficulties, concentration difficulties
  - Light sensitivity, motion sensitivity, difficulty tracking objects, pain with eye movements
  - Vestibular issues (balance, dizziness), issues with spatial attention
- **Less common:**
  - Blurry vision, double vision
  - Visual field loss, pupil changes, issues with dark adaptation

1. Master CL *et al* (2018) *Clin J Sport Med* 28(2): 139-145
2. Ciuffreda KJ *et al* (2007) *Optometry* 78: 155-161
3. Brahm K *et al*. (2009) *Optom Vis Sci* 86(7): 817-825
4. Goodrich G *et al*. (2013) *Optom Vis Sci* 90(2): 105-112

Optometry Post-Concussion

- Optometrists are not typically involved in acute concussion management

- Optometrists are involved in the management of patients with persisting post-concussion symptoms [1,2,3]
  - Part of patient's multidisciplinary care team

1. Marshall S., Lithopoulos A., Curran D., Fischer L., Velikonja D., & Bayley, M. (2023). Living Concussion Guidelines: Guideline for Concussion & Prolonged Symptoms for Adults 18 years of Age or Older. https://concussionsontario.org
2. Reed, N., Zemek, R., Dawson, J., Ledoux, AA., et al. (2023). Living Guideline for Pediatric Concussion Care. www.pedsconcussion.com.
3. Parachute Canada. Canadian Guideline on Concussion in Sport (28 September 2022). https://parachute.ca/en/professional-resource/concussion-collection/canadian-guideline-on-concussion-in-sport/

Post-Concussion Optometry Assessments

- Assessments should include [1]
  1. Complete vision exam, including careful refraction and a dilated ocular health assessment
  2. Visual function assessment, including accommodation, convergence, and eye movement testing

  - Non-vision-based problems should also be considered, and referrals made as needed
    - Cognitive impairments, psychological disorders, neurological impairments, etc.

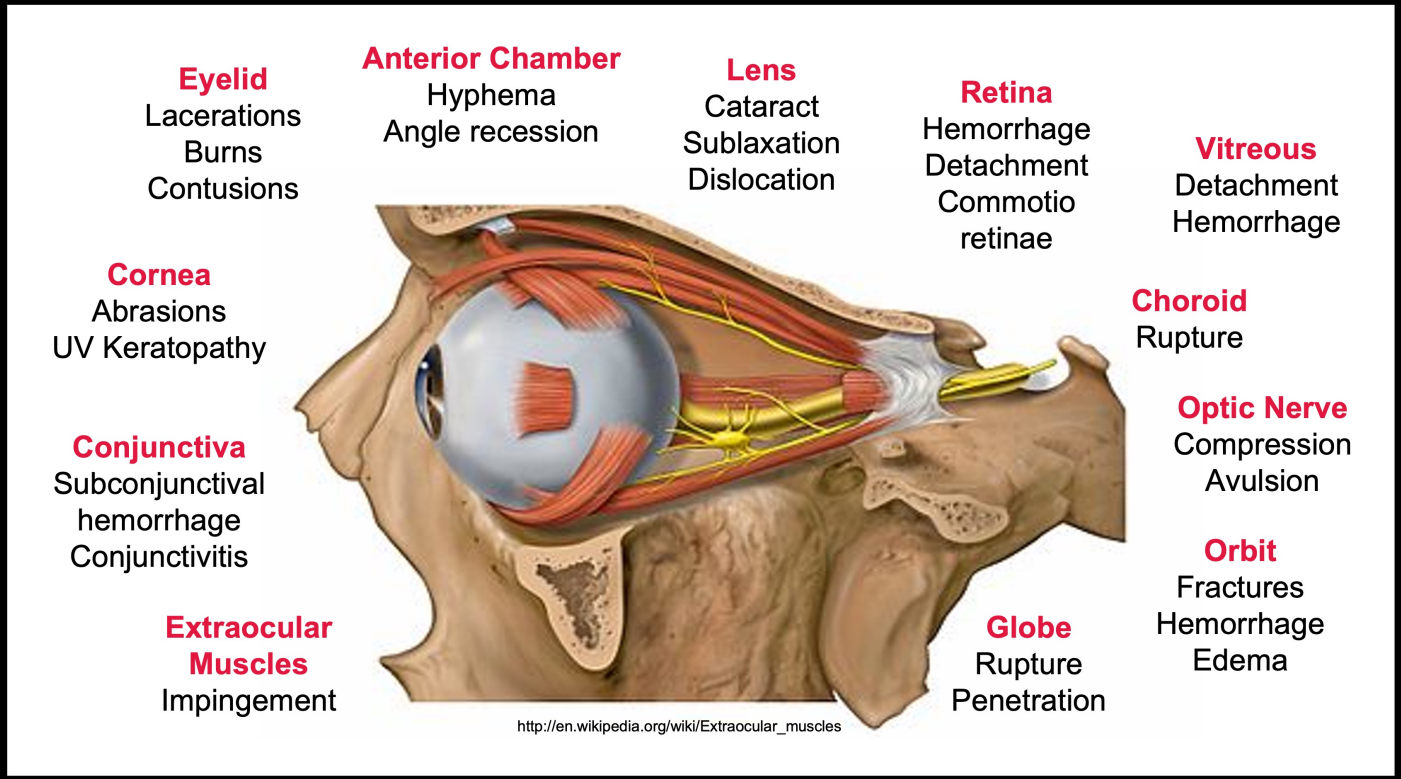
1. Ciuffreda, K. J., Ludlam, D. P., Yadav, N.K. & Thiagarajan, P. T. (2016). Advances in Ophthalmology and Optometry. 1(1); 307–333.

Optometry Management Post-Concussion

- Post-concussion vision issues should be managed in the following order
  1. Structural abnormalities
  2. Refractive error and light sensitivity
  3. Visual function and visual perception deficits

Ocular Injuries

- Sports-related eye injuries = 9% of all eye injuries requiring medical attention
  - Structural abnormalities due to damage to the eye need to be addressed as a **first priority**



1. Gordon, KD (2012), The incidence of eye injuries in Canada. *Can J Ophthalmol, 47:351 353*
2. Erickson, G (2007) Sports Vision: Vision Care for the Enhancement of Sports Performance. Butterworth Heinemann, Philadelphia, USA.

Refractive Error

- Deficits with the accommodation system are common and can affect spectacle prescriptions
  - Some patients experience a myopic (nearsighted) shift in their spectacle prescription [1-4]
  - Other patients, can benefit from hyperopic (farsighted) prescriptions [5]
- Accurate spectacle corrections can improve persisting post-concussion symptoms

1. Chan RV, Trobe JD. *J Neuroophthalmol*. 2002;22:15-17.
2. London R, Wick B, Kirschen D. *Optometry*. 2003;74:111-120.
3. Leslie S. *Opt Vis Dev*. 2009;40:25:31.
4. Fortenbaugh FC, Gustafson JA, Fonda JR, Fortier CB, Milberg WP, McGlinchey RE. *Vision Research*. 2021; 186:1-12.
5. Chinn RN, Wiecek E, Raghuram A. ARVO Meeting Abstract. *Investigative Ophthalmology & Visual Science*. July 2019, Vol.60, 1804

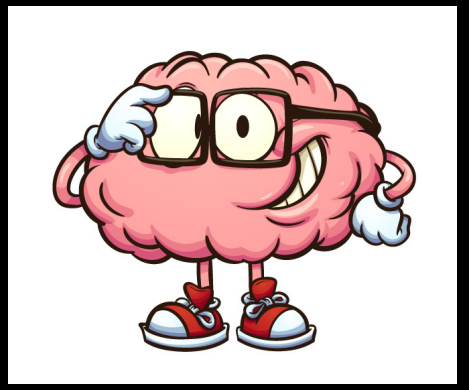
Light Sensitivity

- Tint trials should be done once the refractive error is fully corrected
  - Blues, Plums, Roses, Blue-Green / Green-Blue, Glare Cutters, Neutral Greys, Yellows, Reds

www.chadwickoptical.com

Post-Concussion Refractive Management

- Correct refractive errors as accurately as possible
  - Tints can be worn full time, or as needed for light sensitivity
  - Use relieving prism as needed for binocular vision deficits
- Change glasses first and re-assess once adapted
  - Adaptation often takes 3-4 weeks
  - Initiate vision therapy as needed, after adaptation to glasses

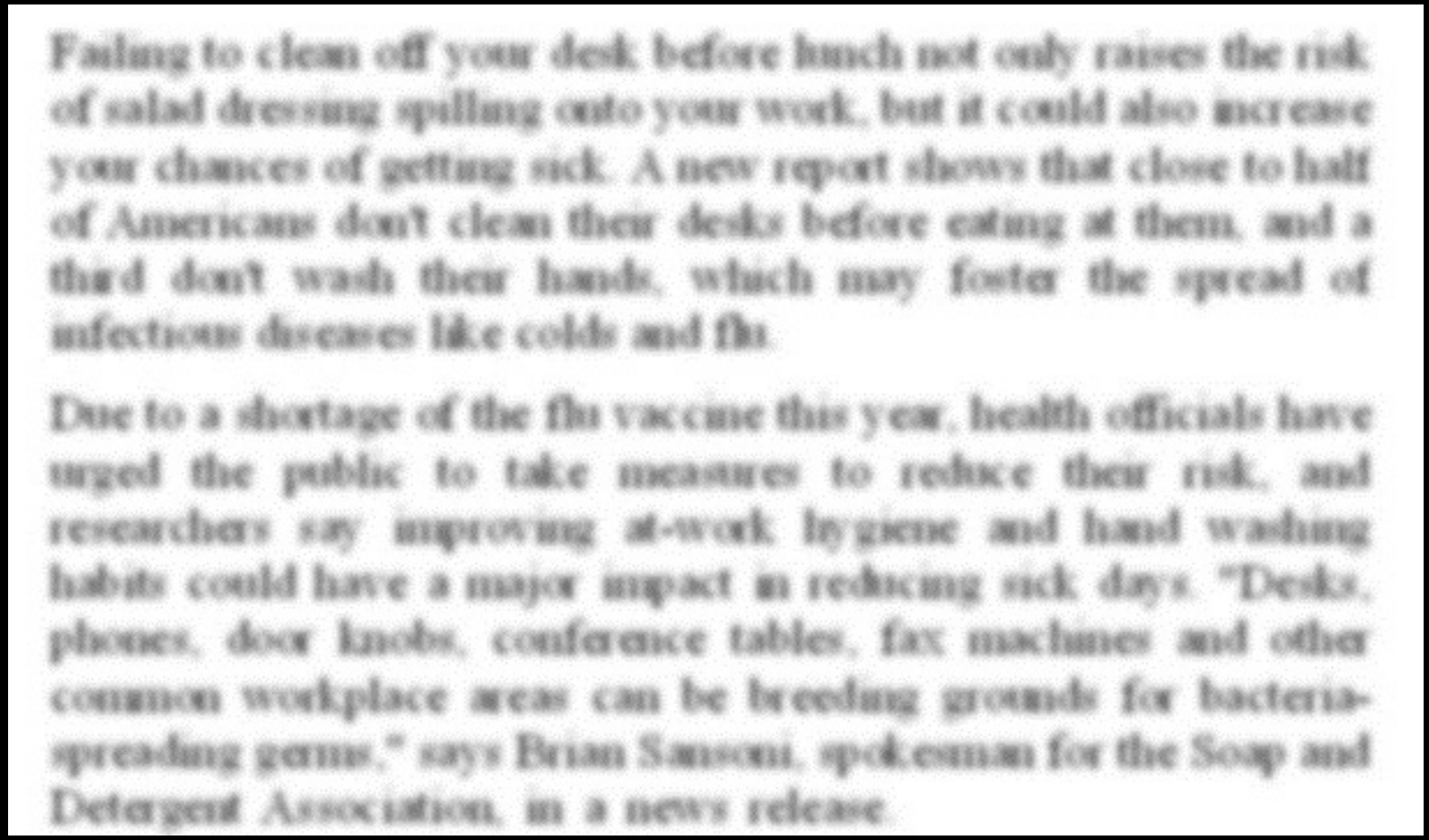


Visual Function Deficits

- The most common visual function deficits following concussion include
  - Accommodative (focusing) disorders
  - Convergence insufficiency
  - Saccadic eye movement disorders

1. Master CL, et al. Vision Diagnoses are Common after Concussion in Adolescents. Clin Pediatr (Phila); 2016, 55(3): 260-267.

Accommodation Deficits



Failing to clean off your desk before lunch not only raises the risk of salad dressing spilling onto your work, but it could also increase your chances of getting sick. A new report shows that close to half of Americans don't clean their desks before eating at them, and a third don't wash their hands, which may foster the spread of infectious diseases like colds and flu.

Due to a shortage of the flu vaccine this year, health officials have urged the public to take measures to reduce their risk, and researchers say improving at-work hygiene and hand washing habits could have a major impact in reducing sick days. "Desks, phones, door knobs, conference tables, fax machines and other common workplace areas can be breeding grounds for bacteria-spreading germs," says Brian Sansoni, spokesman for the Soap and Detergent Association, in a news release.

Image: Reading, Learning and Behavioral Problems May Stem From Vision Dysfunctions. Hope Clinic. https://www.hopecliniconline.com/vision-dysfunctions/reading-learning-and-behavioral-problems/

Convergence Deficits Insufficency

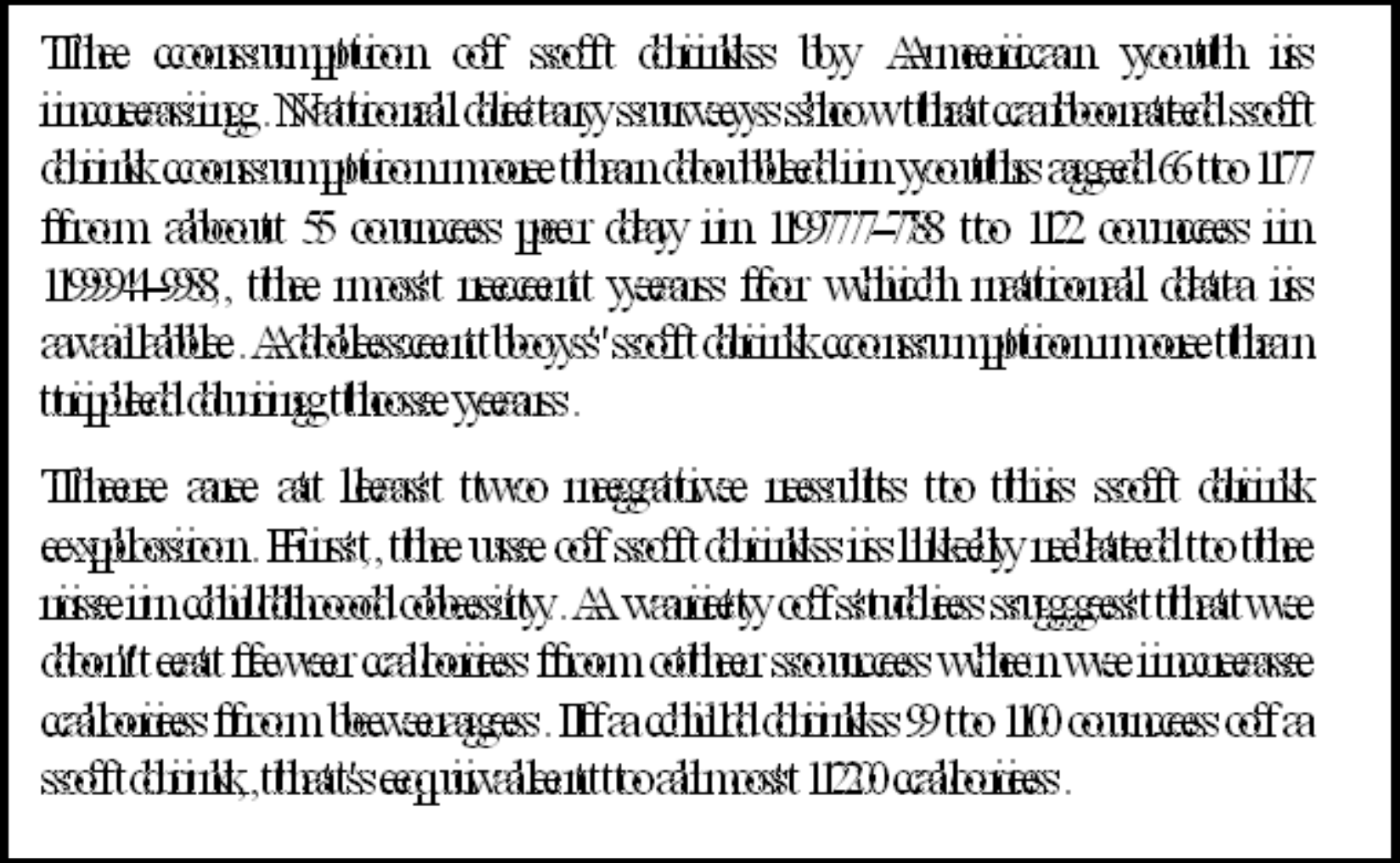
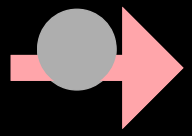


Image: Randhawa MK. Reading and Vision. Vision Therapy Vancouver; https://www.visiontherapy.ca/reading-and-vision.html

Eye Movement Problems

Fixations 

Pursuits 

Saccades 

Post-Concussion Vision Therapy

- Vision therapy is typically provided by optometrists with specialized training and can benefit some patients with persistent concussion symptoms[2]
  - Appears to be most effective for accommodative dysfunction, convergence insufficiency, and oculomotor dysfunctions [3,4,5]
  - Can also improve persistent post-concussion symptoms in some patients [3,4]

1. Marshall S., Lithopoulos A., Curran D., Fischer L., Velikonja D., & Bayley, M. (2023). Living Concussion Guidelines: Guideline for Concussion & Prolonged Symptoms for Adults 18 years of Age or Older. https://concussionsontario.org
2. Gallaway M, Scheiman, M, Mitchell GL. Vision Therapy for Post-Concussion Vision Disorders. Optometry & Vision Science, 2017; 94(1): 68-73.
3. Roby PR, Podolak OE, Grady M, Arbogast KB, Master CL. The effect of a home exercise program on visio-vestibular function in concussed pediatric patients. Front Sports Act Living. 2023 Mar 3;5:1064771.
4. Santo AL, Race ML, Teel EF. Near Point of Convergence Deficits and Treatment Following Concussion: A Systematic Review. Journal of Sport Rehabilitation, 2020: 29(8), 1179-1193.

Post-Concussion Vision Therapy

- Vision therapy can be considered in patients with persistent post-concussion symptoms who have visual dysfunction
  - Patient's refractive error must be fully corrected first
- Vision therapy typically consists of a collection of vision exercises that can be done in-office or at-home [1,2]
  - Both in-office and at-home therapy can be effective

1. Gallaway M, Scheiman, M, Mitchell GL. Vision Therapy for Post-Concussion Vision Disorders. Optometry & Vision Science, 2017; 94(1): 68-73.
2. Roby PR, Podolak OE, Grady M, Arbogast KB, Master CL. The effect of a home exercise program on visio-vestibular function in concussed pediatric patients. Front Sports Act Living. 2023 Mar 3;5:1064771.

Post-Concussion Vision Therapy

- Establish good monocular function first
  - Accommodation, oculomotor control
- Incorporate binocular functions training as able
  - Anti-suppression training, convergence and divergence
- Incorporate work on visual-spatial awareness and vestibular function simultaneously
  - Peripheral awareness, visual-motor coordination, visual motion tolerance, etc.
    - Physiotherapists should be involved in vestibular rehabilitation programs

Image: Tison K and Nciklas A. Managing Amblyopia: Can Vision Therapy Cut It? Review of Optometry; 15 October 2017. https://www.reviewofoptometry.com/article/managing-amblyopia-can-vision-therapy-cut-it

Post-Concussion Vision Therapy

- Binasal occlusion
- Yoked prisms for midline shift
- Syntonics (ocular light exposure therapy)

The evidence supporting these vision therapy interventions is very limited. [1-4]

Much more research is needed to determine if these are effective treatments for persistent concussion symptoms.

1. Simpson-Jones ME, Hunt AW. Vision rehabilitation interventions following mild traumatic brain injury: a scoping review. Disabil Rehabil. 2019 Sep;41(18):2206-2222.
2. Barton JJS, Ranalli PJ. Vision therapy: Occlusion, prisms, filters, and vestibular exercises for mild traumatic brain injury. Surv Ophthalmol. 2021 Mar-Apr;66(2):346-353
3. Labreche T, Wild B, Dalton K, Leat SJ. Post-stroke visual midline shift syndrome. Clin Exp Optom. 2020 May;103(3):290-295. doi: 10.1111/cxo.12944. Epub 2019 Jul 18. PMID: 31321827.
4. López de la Fuente, Carmen PhD1,2*; Sánchez-Cano, Ana Isabel PhD1,2. Photometric and Colorimetric Evaluation of Phototherapy Instruments for Syntonic Treatment of Visual Anomalies. Optometry and Vision Science 98(12):p 1355-1365, December 2021.

Post-Concussion Vision Therapy

- There is no set number of treatments or duration of vision therapy that works for every patient
  - Progress should be monitored every 1 to 2 months, to determine if additional sessions are needed
    - Continued progression of vision therapy should involve a re-assessment of visual function, along with a conversation with the patient about how they would like to proceed

Concussion in Athletes with Vision Impairment

- Concussion incidence in Para sport is comparable to able-bodied sport[1]
  - May even be higher in athletes with vision impairment (VI)[1]

- Concussion symptoms can be more challenging to recognize in athletes with VI[2,3]

CIPS Concussion in Para Sport Position Paper
https://bjsm.bmj.com/content/55/21/1187

1. Fagher K, Jacobsson J, Timpka T, Dahlström Ö, Lexell J. BMC Sports Sci Med Rehabil. 2016 Aug 30;8(1):28.
2. Weiler R, Blauwet C, Clarke D, et al. British Journal of Sports Medicine 2021;55:1187-1195.
3. Canadian Blind Sports Association. Concussion and Vision Impairments. http://canadianblindsports.ca/resources/concussion-and-visual-impairments/

Concussion in Athletes with Vision Impairment

- Optometric assessment of athletes with vision impairment and concussion is of critical importance
  - Identify whether vision deficits are due to the concussion or pre-existing visual condition
  - Athletes with VI may also require unique accommodations during recovery due to demands of navigating a visual world with limited or no vision

Canadian Blind Sports Association – Concussion Resources
http://canadianblindsports.ca/resources/concussion-and-visual-impairments/

Canadian Blind Sports
Sports Aveugles Canada

In Summary

- **Optometrists can help determine if vision deficits are present**
  - Structural assessment (routine eye exam) with dilation
  - Visual function assessment, includes accommodation, convergence, and eye movement testing
- **Post-concussion vision deficits can often be treated with glasses and/or vision therapy exercises**
  - More research is needed
  - Management needs to be patient-centered

Thank you!