

Post-traumatic Convergence Insufficiency with Associated Accommodative Disorders in a Patient after Blunt Head Trauma

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Summary:

Blunt head trauma is often accompanied by visual disturbances that require comprehensive ophthalmological evaluation. These symptoms may be transient and sometimes resolve spontaneously, but they should not be ignored, as they may indicate significant functional impairments of the visual system. This paper presents the case of a 26-year-old man who, following blunt head trauma with a brief loss of consciousness, developed convergence insufficiency accompanied by accommodative dysfunction.

Key words:

convergence insufficiency, accommodation disorders, blunt head trauma, post-traumatic visual disturbances, diplopia.

Introduction

Head injuries are among the leading causes of death and post-traumatic disability worldwide. It is estimated that they affect approximately 69 million people annually, most commonly as a result of traffic accidents [1]. In Europe, despite high safety standards, head injuries continue to pose considerable diagnostic and therapeutic challenges and remain a significant socio-economic problem [2]. In Poland, a total of 194,553 hospitalizations due to head injuries were recorded between 2009 and 2012 [3]. Such injuries are frequently accompanied by visual disturbances. Studies show that as many as 65–79% of patients with head trauma, even without clinically visible ocular damage, report visual dysfunctions [4–10].

Case report

A 26-year-old man presented to the Ophthalmology Outpatient Clinic in Bielsko-Biała due to decreased visual acuity for both distance and near vision, as well as diplopia at near, which had been present for two days. His medical history was unremarkable: he denied chronic diseases, was not on long-term medications, reported no prior surgical procedures, and did not use corrective glasses or contact lenses. He stated that he had never experienced visual problems and had successfully passed his sports medical examinations. According to the patient, three days earlier, during a football match, he sustained blunt head trauma with a brief loss of consciousness. On the day of the injury, he was examined in the Hospital Emergency Department in Bielsko-Biała, reporting dizziness and transient memory disturbances, which resolved within a few hours. Head imaging was performed; computed tomography revealed no significant abnormalities or damage to the bony structures. The patient was also evaluated neurologically, and the examination showed no relevant pathology. He was discharged home with recommendations for follow-up by his primary care physician.

On the day of the ophthalmological consultation, the clinical examination revealed:

- ✓ uncorrected distance visual acuity: VOD 0.2, VOS 0.4;
- ✓ autorefractometry after administration of 1% tropicamide: OD +3.0/-0.50×160; OS +2.5/-0.25×150;
- ✓ corrected distance visual acuity: VOD cc +2.5 dsph = 1.0; VOS +2.0 dsph = 1.0;
- ✓ near visual acuity: binocularly 0.5 (decimal) with the above correction; the patient reports diplopia.
- ✓ measurement of intraocular pressure: OD 15 mmHg; OS 16 mmHg;
- ✓ ocular motility: normal in all directions; convergence markedly reduced; diplopia at near;
- ✓ distance CT: within normal limits;
- ✓ anterior segment: normal, no deviations; direct and consensual pupillary light reactions normal;
- ✓ fundus of the OD and OS: no visible abnormalities;
- ✓ macular OCT of the OD and OS: no abnormalities (Fig. 1.);
- ✓ OCT of the optic nerve head (OD and OS): RNFL thickness within normal limits across all sectors (Fig. 2.);
- ✓ visual field 120-2 of the OD and OS: within normal limits (Fig 3A and 3B).

Based on the clinical presentation, post-traumatic convergence insufficiency with accompanying accommodative dysfunction was diagnosed, with no evidence of ocular structural damage. Distance spectacle correction was prescribed, and vision therapy with convergence and accommodation exercises was initiated. An MRI of the head was recommended. After four weeks, gradual resolution of near diplopia and restoration of accommodative function were achieved. The patient did not undergo the recommended head MRI and declined further diagnostic evaluation, as his symptoms had resolved.

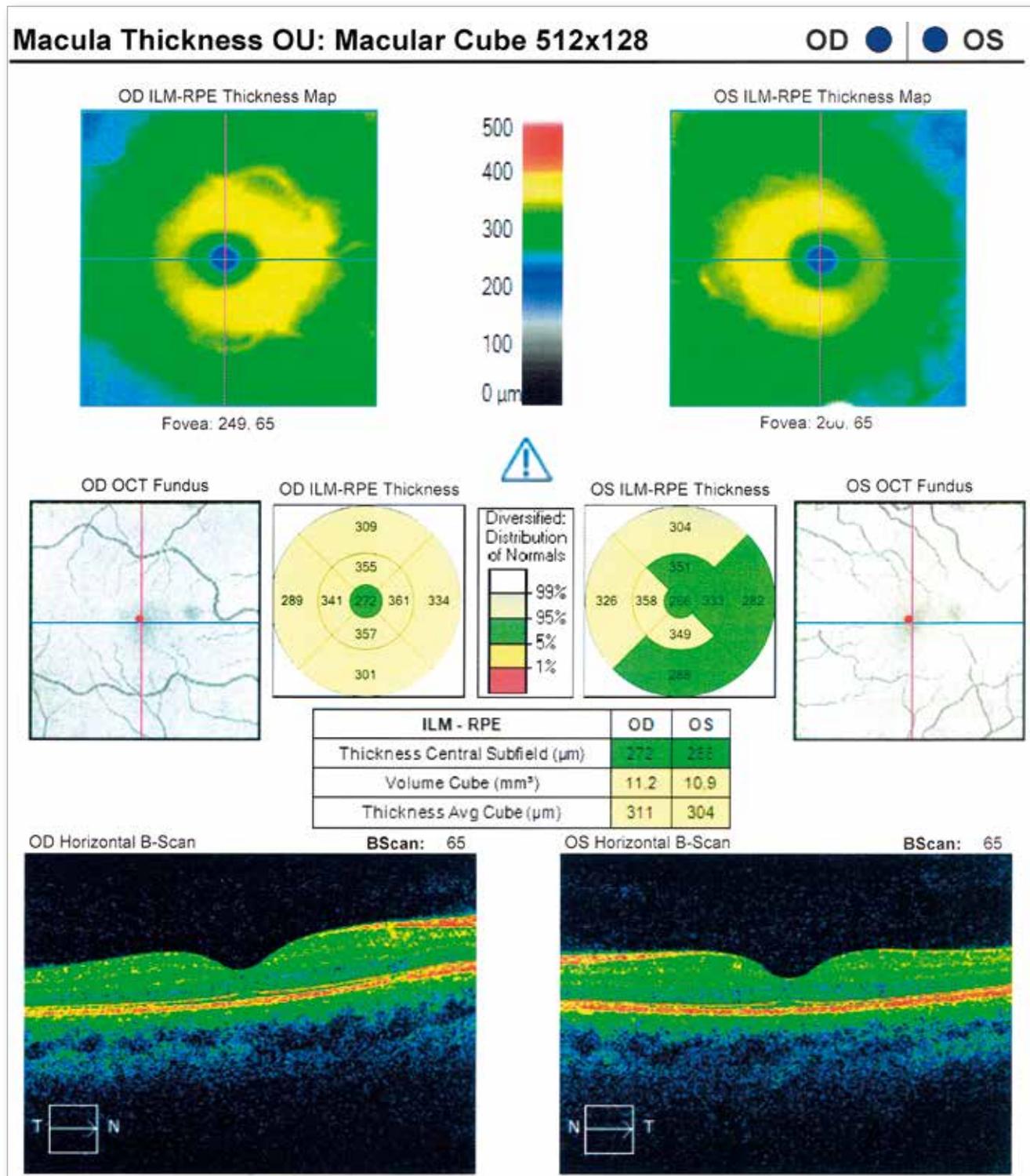


Fig. 1. Optical coherence tomography image of the patient's macula on the day of presentation to the ophthalmology outpatient clinic.

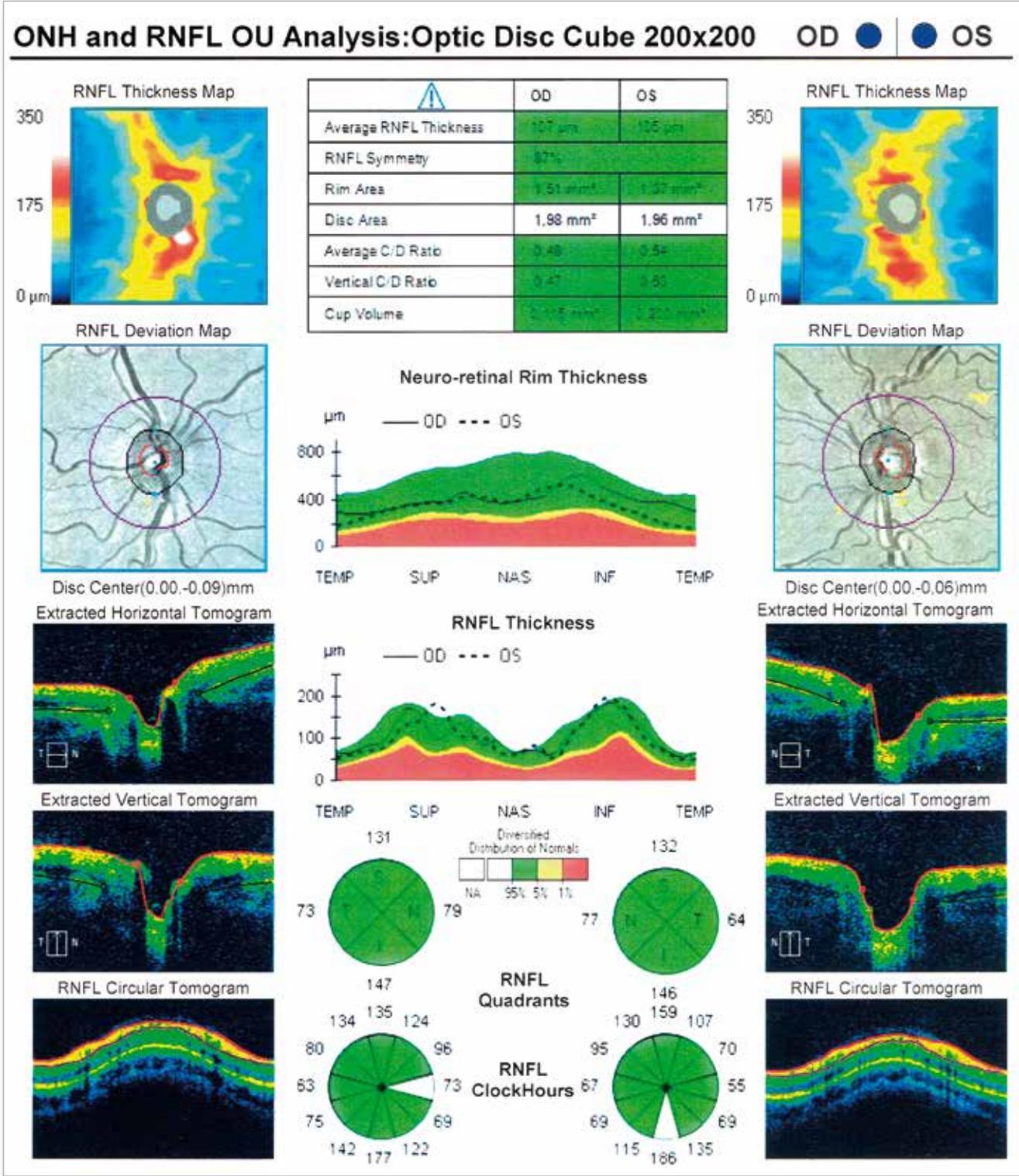


Fig. 2. Optical coherence tomography image of the patient’s optic nerve head on the day of presentation to the ophthalmology outpatient clinic.

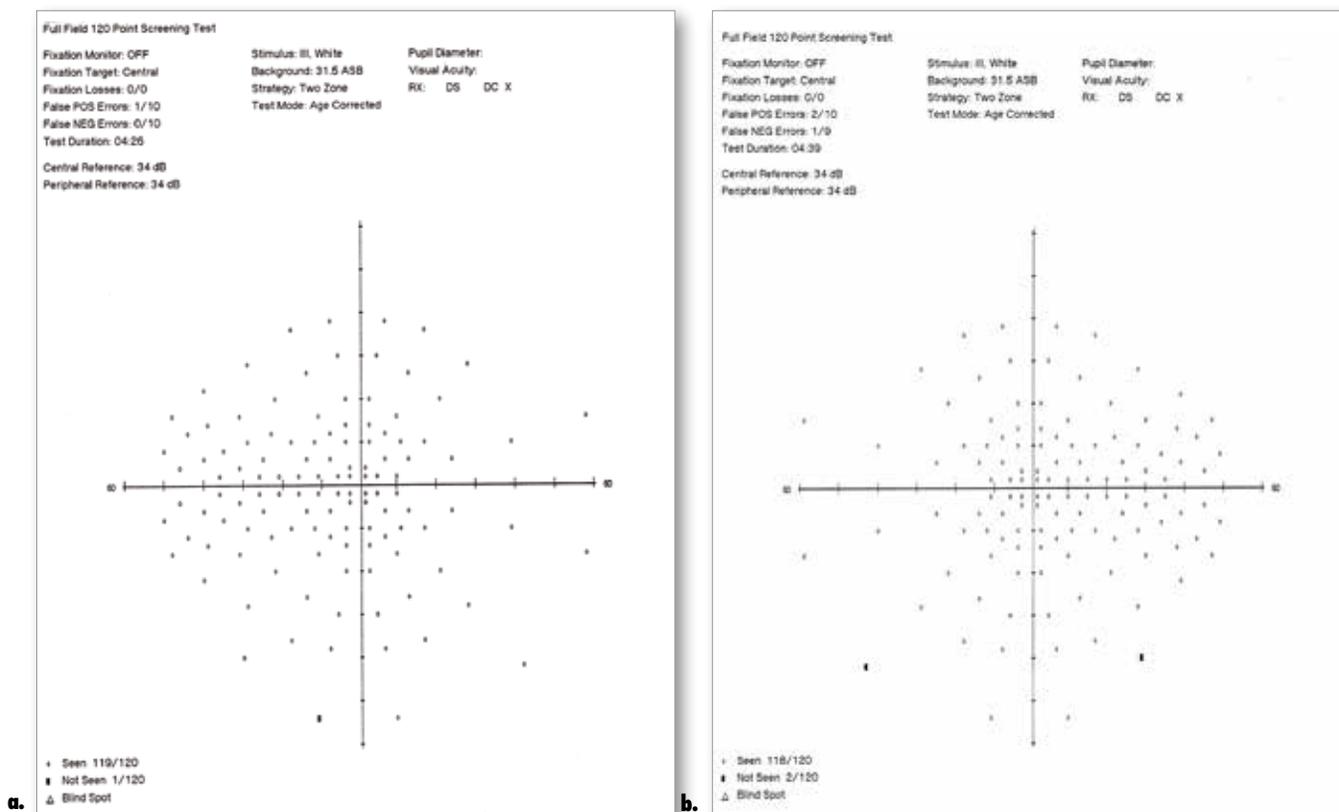


Fig. 3. Visual field examination of the patient on the day of presentation to the ophthalmology outpatient clinic. A – right eye, B – left eye.

Discussion

The patient exhibited clinical features typical of post-traumatic concussion, including brief loss of consciousness and transient disturbances of memory and orientation to time, place and person. These symptoms are often accompanied by visual disturbances, including reduced visual acuity, diplopia, reading difficulties, rapid visual fatigue, and photophobia [11]. A meta-analysis by Merezhinskaya et al., involving a total of 1,271 patients after blunt head trauma, demonstrated that the most common ophthalmic manifestation is accommodative dysfunction, affecting approximately 42.8% of patients [4]. Differential diagnosis should include uncorrected hyperopia, oculomotor nerve palsy, ciliary ganglion injury, central nervous system infections, and systemic diseases such as diabetes [12]. Convergence dysfunction following head trauma most often presents as convergence insufficiency, and very rarely as excessive convergence. The prevalence of convergence disorders is estimated at approximately 36.3% [4]. Differential diagnosis should also consider primary vergence dysfunction, uncorrected hyperopia, as well as neurological and neurodegenerative diseases [13]. Given that the patient had successfully passed regular sports medical examinations and had not previously reported such complaints, primary vergence disorders can be excluded. Visual field defects after head trauma occur in approximately 18.2% of patients [4]. Depending on the location of the injury, visual field defects may present as heteronymous hemianopia when situated near the optic chiasm, or as homonymous hemianopia when involving the optic radiation or optic tract. Merezhinskaya et al. also report cases of post-traumatic quadrantanopic defects, visual field constriction, and central or paracentral scotomas [4]. After head trauma, ocular motility disorders frequently occur due to injury to the oculomotor nerves (III, IV, VI), and less commonly due to internuclear ophthalmoplegia. Damage to the sympathetic pathway may manifest as post-traumatic Horner syndrome. In all such cases, proliferative changes, including neoplastic proces-

ses, as well as vascular pathologies, must be definitively excluded [14]. Head trauma may also be accompanied by strabismus, nystagmus, disturbances of spatial vision, and abnormal pupillary reflexes [14, 15]. In extreme cases, injury to the occipital region may lead to cortical blindness, reflecting bilateral dysfunction of the cortical visual centers [15]. Head trauma may also give rise to late ocular complications. Laws et al. reported thinning of the retinal nerve fiber layer and ganglion cell complex several weeks after head trauma, even when initial CT imaging revealed no abnormalities [16]. Wei et al. observed increased intraocular pressure following blunt head trauma in the absence of structural ocular damage [17].

In the presented case, spectacle correction and targeted vision therapy (convergence and accommodation exercises) were applied, resulting in significant improvement within four weeks, including resolution of near diplopia and restoration of normal accommodation. However, it should be emphasized that this is a single-case observation. Therefore, it is not possible to determine to what extent the improvement was attributable to the intervention itself, as opposed to the natural course of mild post-traumatic visual disturbances following blunt head trauma, which often resolve spontaneously. Subramanian et al. report that vision therapy after head trauma is used clinically and may be associated with improvement, but the available evidence (mainly case reports and case series) does not allow for definitive conclusions regarding its causal effectiveness [18].

Conclusions

Given the wide spectrum of ocular sequelae associated with head injuries, diagnostic evaluation – alongside standard imaging and neurological assessment – should also include a comprehensive ophthalmological examination. Assessment should comprise distance and near visual acuity, ocular motility with cover test, evaluation of accommodation and convergence, pupillary reac-

tions (direct and consensual), intraocular pressure measurement, biomicroscope assessment of the anterior segment, and dilated fundus examination. It is also advisable to perform optical coherence tomography, perimetry, and, in cases of non-transparent optical media, ocular ultrasonography. In selected situations, electrophysiological testing may be required. Management of visual disturbances in patients after blunt head trauma should be individualized and directed toward causal therapy, which often results in significant functional improvement.

Disclosure

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References:

- Dewan MC, Rattani A, Gupta S, et al.: *Estimating the global incidence of traumatic brain injury*. J Neurosurg. 2018 Apr 27; 130(4): 1080–1097. doi: 10.3171/2017.10.JNS17352. PMID: 29701556.
- Majdan M, Plancikova D, Brazinova A, et al.: *Epidemiology of traumatic brain injuries in Europe: a cross-sectional analysis*. Lancet Public Health. 2016 Dec; 1(2): e76–e83. doi: 10.1016/S2468-2667(16)30017-2. Epub 2016 Nov 29. PMID: 29253420.
- Miekisiak G, Czyz M, Tykocki T, et al.: *Traumatic brain injury in Poland from 2009-2012: A national study on incidence*. Brain Inj. 2016; 30(1): 79–82. doi: 10.3109/02699052.2015.1104550. Epub 2015 Dec 29. PMID: 26714216.
- Merezhinskaya N, Mallia RK, Park D, et al.: *Visual Deficits and Dysfunctions Associated with Traumatic Brain Injury: A Systematic Review and Meta-analysis*. Optometry and Vision Science. 2019 Aug; 96(8): p. 542–555. doi: 10.1097/OPX.0000000000001407.
- Brahm KD, Wilgenburg HM, Kirby J, et al.: *Visual Impairment and Dysfunction in Combat-injured Service members with Traumatic Brain Injury*. Optom Vis Sci. 2009; 86: 817–825.
- Goodrich GL, Kirby J, Cockerham G, et al.: *Visual Function in Patients of a Polytrauma Rehabilitation Center: A Descriptive Study*. J Rehabil Res Dev. 2007; 44: 929–936.
- Lew HL, Poole JH, Vanderploeg RD, et al.: *Program Development and Defining Characteristics of Returning Military in a VA Polytrauma Network Site*. J Rehabil Res Dev. 2007; 44: 1027–1034.
- Capó-Aponte JE, Jorgensen-Wagers KL, Sosa JA, et al.: *Visual Dysfunctions at Different Stages after Blast and Non-blast Mild Traumatic Brain Injury*. Optom Vis Sci. 2017; 94: 7–15.
- Stelmack JA, Frith T, van Koeveing D, et al.: *Visual Function in Patients Followed at a Veterans Affairs Polytrauma Network Site: An Electronic Medical Record Review*. Optometry. 2009; 80: 419–424.
- Goodrich GL, Flyg HM, Kirby JE, et al.: *Mechanisms of TBI and Visual Consequences in Military and Veteran Populations*. Optom Vis Sci. 2013; 90: 105–112.
- Shteyman A, deBroff BM: *Ophthalmic Manifestations, Evaluation, and Guidelines for Testing of Concussion*. The Open Ophthalmology Journal. 2023 Feb 10. doi: 10.2174/18743641-v17-e230111-2022-43.
- Enaholo ES, Musa MJ, Zeppieri M: *Accommodative Insufficiency*. [Updated 2023 May 31]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2025 Jan-. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK587363/>
- Goering M, Drennan KB, Moshirfar M: *Convergence Insufficiency*. [Updated 2023 Jul 18]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2025 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK554390/?utm_source=chatgpt.com
- Abu Samra K: *Understanding the Neuro-ophthalmology of Head Trauma: A Review of the Current Literature*. Asia-Pacific Journal of Ophthalmology, Volume 3, Issue 4, 2014, Pages 230-234, ISSN 2162-0989, <https://doi.org/10.1097/APO.0000000000000051>.
- Zhang K, Truong T, He CH, et al.: *Traumatic Brain Injury in Admitted Patients with Ocular Trauma*. Turk J Ophthalmol. 2024 Aug 28; 54(4): 212–222. doi: 10.4274/tjo.galenos.2024.27737. Epub 2024 Aug 7.
- Laws E, Metry Y, Bin Saliman NH, et al.: *Retinal manifestations of traumatic brain injury*. Sci Rep. 2025; 15, 14992. <https://doi.org/10.1038/s41598-025-94091-1>.
- Wei H, Spaeth GL: *Head trauma can cause transient elevation of intraocular pressure in patients with open angle glaucoma*. Int J Ophthalmol. 2011; 4(3): 298–302. doi: 10.3980/j.issn.2222-3959.2011.03.18. Epub 2011 Jun 18. PMID: 22553666; PMCID: PMC3340807.
- Subramanian PS, Barton JJS, Ranalli P, et al.: *Consensus Statement on Visual Rehabilitation in Mild Traumatic Brain Injury*. Neurol Clin Pract. 2022 Dec; 12(6): 422–428. doi: 10.1212/CPJ.0000000000200071. PMID: 36540149; PMCID: PMC9757109.

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