DEFENSE CENTERS OF EXCELLENCE
For Psychological Health & Traumatic Brain Injury

Assessment and Management of Visual Dysfunction Associated with Mild Traumatic Brain Injury

Clinical Recommendation Overview

VISION Center of Excellence
DVBIC Defense and Veterans Brain Injury Center
DHCC Deployment Health Clinical Center
National Center for Telehealth & Technology

Learning Objectives

- Describe an overview of visual dysfunction associated with mTBI
- Identify key screening and eye/visual assessments
- List the red and yellow flags requiring urgent and priority specialty referrals
- Demonstrate practical application of the clinical algorithm
- Formulate management options for continued evaluation and co-morbidities of persistent visual symptoms

Scope of Clinical Recommendation

This clinical recommendation is intended for health care professionals in the Department of Defense (DoD) (primary and specialty care) who assess and manage the care of patients complaining of visual disturbances associated with mTBI.

DoD Photo
Source: DefenseImagery.mil

Introduction

This education slide deck contains introductory materials for those who are new to the subject of visual dysfunction associated with mTBI. However, it is assumed that the reader has a basic knowledge of TBI, including assessment, treatment, and differentiation between mild, moderate, and severe TBI.

Source : The DCoE Blog http://www.dcoe.health.mil/blog/article.aspx?id=1&postid=196

Additional resources related to mild TBI can be obtained by completing the Mild TBI Web-based Case Study, Case Study 1: Diagnosing Mild TBI, which is available on the MHS Learn DoD staff portal for DoD providers, on the MHS Learn civilian provider portal for civilian providers, and on the Department of Veterans Affairs (VA) Talent Management System (TMS) for VA providers.

Traumatic Brain Injury

- With more than 262,000 traumatic brain injuries (TBIs) in DoD from 2000 to 2012, TBI is a major concern that can negatively impact service members' health, unit readiness and mission accomplishment
- TBI is a disruption of brain function resulting from a blow or jolt to the head
- TBIs are classified as mild, moderate, severe or penetrating
- Majority of these brain injuries (80-85%) documented by DoD are mTBI

DoD Photo
Source: DefenseImagery.mil

Closed TBI Classification

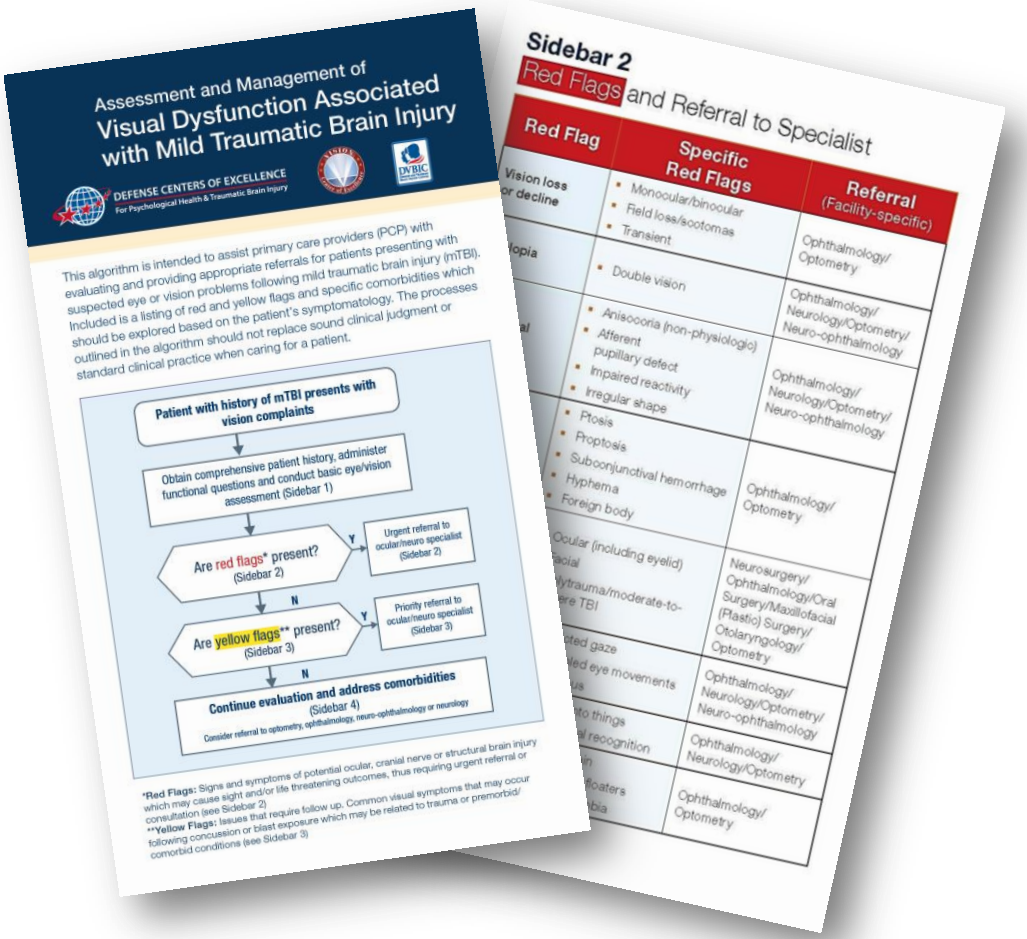
Severity	Mild (Concussion)	Moderate	Severe
Structural imaging	Normal	Normal or abnormal	Normal or abnormal
Loss of consciousness (LOC)	0 to 30 minutes	> 30 minutes and < 24 hours	> 24 hours
Alteration of consciousness (AOC)	a moment up to 24 hours	> 24 hours (Severity based on other criteria)	
Post traumatic amnesia (PTA)	= 0 to 1 day	> 1 day < 7 days	> 7 days

Source: Assistant Secretary of Defense for Health Affairs. Health Affairs Memorandum (October 1, 2007). Traumatic Brain Injury: Definition and Reporting

- This classification refers to severity at the time of injury, not symptoms experienced
- Mild TBI is also known as concussion

Clinical Algorithms

- This presentation is best reviewed with a copy of the *Assessment and Management of Visual Dysfunction Associated with Mild TBI* algorithm cards in hand



Assessment and Management of Visual Dysfunction Associated with Mild Traumatic Brain Injury

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This algorithm is intended to assist primary care providers (PCP) with evaluating and providing appropriate referrals for patients presenting with suspected eye or vision problems following mild traumatic brain injury (mTBI). Included is a listing of red and yellow flags and specific comorbidities which should be explored based on the patient's symptomatology. The processes outlined in the algorithm should not replace sound clinical judgment or standard clinical practice when caring for a patient.

Patient with history of mTBI presents with vision complaints

Obtain comprehensive patient history, administer functional questions and conduct basic eye/vision assessment (Sidebar 1)

Are red flags* present? (Sidebar 2) — Y → Urgent referral to ocular/neuro specialist (Sidebar 2)

N

Are yellow flags** present? (Sidebar 3) — Y → Priority referral to ocular/neuro specialist (Sidebar 3)

N

Continue evaluation and address comorbidities (Sidebar 4)

Consider referral to optometry, ophthalmology, neuro-ophthalmology or neurology

*Red Flags: Signs and symptoms of potential ocular, cranial nerve or structural brain injury which may cause sight and/or life threatening outcomes, thus requiring urgent referral or consultation (see Sidebar 2)

**Yellow Flags: Issues that require follow up. Common visual symptoms that may occur following concussion or blast exposure which may be related to trauma or premorbid/comorbid conditions (see Sidebar 3)

Sidebar 2
Red Flags and Referral to Specialist

Red Flag	Specific Red Flags	Referral (Facility-specific)
Vision loss or decline	• Monocular/binocular • Field loss/scotomas • Transient	Ophthalmology/ Optometry
opia	• Double vision	Ophthalmology/ Neurology/Optometry/ Neuro-ophthalmology
al	• Anisocoria (non-physiologic) • Afferent pupillary defect • Impaired reactivity • Irregular shape	Ophthalmology/ Neurology/Optometry/ Neuro-ophthalmology
	• Ptosis • Proptosis • Subconjunctival hemorrhage • Hyphema • Foreign body	Ophthalmology/ Optometry
	Ocular (including eyelid) acial lytrauma/moderate-to-re TBI	Neurosurgery/ Ophthalmology/Oral Surgery/Maxillofacial (Plastic) Surgery/ Otolaryngology/ Optometry
	ted gaze ted eye movements us	Ophthalmology/ Neurology/Optometry/ Neuro-ophthalmology
	o things l recognition	Ophthalmology/ Neurology/Optometry
	floaters bia	Ophthalmology/ Optometry

To obtain these algorithm cards visit: www.dvbic.org

Pathophysiology

- Visual dysfunction is a common co-occurring disorder associated with mTBI, and has a significant functional impact on the lives of affected Service members and Veterans

- Two of the most common forms of visual dysfunction following mTBI are:
  1. Oculomotor dysfunctions
  2. Visual field loss

- Visual dysfunction can be the result of direct trauma to the eye and orbit as well as from neurologic injury following concussion, blast exposure, or other head trauma

Oculomotor Dysfunction

- TBI-related Oculomotor Dysfunctions are those acquired conditions affecting eye alignment, eye movement, and/or eye coordination and about which the patient may be unaware.

This affects the following:

- Heterotropia/Heterophoria
- Saccadic eye movements
- Smooth pursuit eye movements
- Convergence

DoD Photo : TSgtPrentice Colter
Source: DefenseImagery.mil

Oculomotor Dysfunction

Heterotropia/Heterophoria

- According to *Companion for Clinical Neurology*, heterotropia is defined as “eye deviations manifest during binocular vision”
- Heterophoria is normal eye fixation until one eye is covered (cover-uncover test), causing one or both eyes to deviate
- Examples of these conditions include phoria, esotropia, and exotropia (strabismus)

Source: Pryse-Phillips, W. (2003). *Companion for Clinical Neurology.* Retrieved from http://books.google.com

Oculomotor Dysfunction

Saccadic Movements

- The ability to track a moving target with the eyes accurately
- Necessary for tracking skills while reading or copying information
- Examples of abnormal saccadic eye movements include nystagmus and opsoclonus (unregulated spontaneous conjugate eye movements)

Source: Open Source Image
http://upload.wikimedia.org/wikipedia/commons/b/b6/Optokinetic_nystagmus.gif

Oculomotor Dysfunction

Smooth Pursuits Movements

- The ability to stabilize gaze and accurately follow a moving object with the eyes accurately
- Common causes of pursuit deficits include trauma, medications, psychological conditions, drugs and alcohol

Source: DCoE Image

Oculomotor Dysfunction

Convergence

- The ability to move the eyes inwardly to binocularly attend an object as it moves closer.
- A common condition following mTBI is convergence insufficiency in which the eyes do not track objects well as they come closer.

Right Eye Divergence

Source: Open Source Image
http://en.wikipedia.org/wiki/Vergence

Visual Field Loss

Visual field is the complete central and peripheral range, or panorama of vision.

Normal visual field:

Source : DefenseImagery.mil
Photo by Staff Sgt. Bob Simons

Common types of visual field loss are:

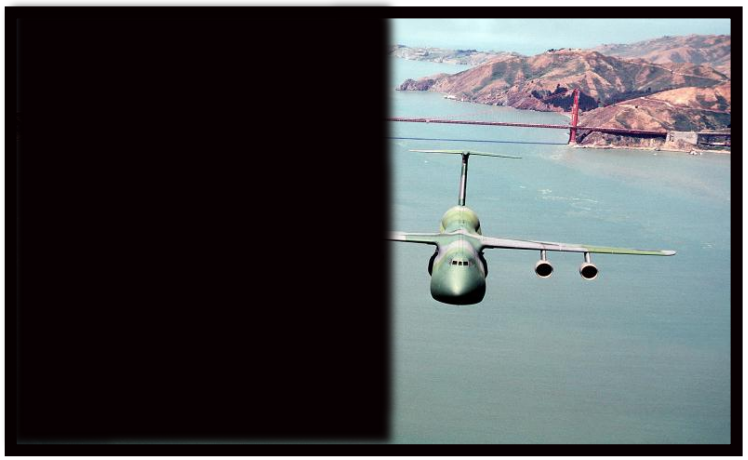
- Hemianopsia
  - Homonymous hemianopsia
  - Bitemporal hemianopsia
- Quadrantanopia

Visual Field Loss

Hemianopsia:

- A condition in which there is a decrease or total loss of a vision field of one or both eyes. If this occurs bilaterally, it can be homonymous (same side) or heteronymous (different sides)

Left Homonymous:



Source : DefenseImagery.mil
Photo by Staff Sgt. Bob Simons

Heteronymous (bitemporal):

Vision Field Loss

Quadrantanopia:

- A condition in which there is a decrease or total loss of a quarter of the visual field
- Also known as quadrantic hemianopia

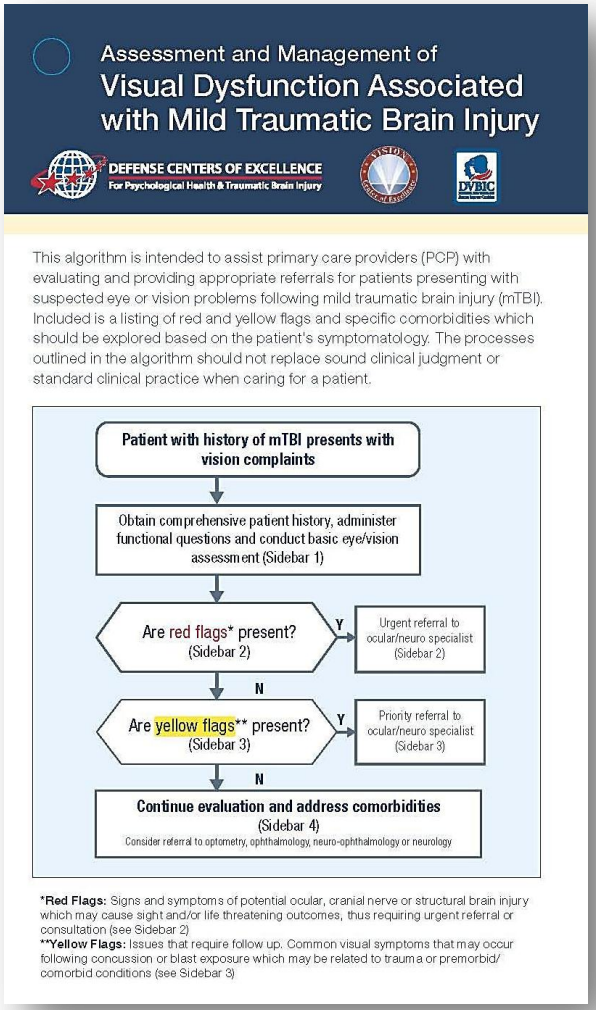
Source : DefenseImagery.mil
Photo by Staff Sgt. Bob Simons

Visual Dysfunction Associated with Mild Traumatic Brain Injury:

Assessment & Management Algorithm

Role of Clinical Algorithm

- Assessment of patients presenting with a complaint of visual dysfunction following an mTBI or possible mTBI includes:
  - Patient history specific to visual complaints
  - Assessment for any red or yellow flags
  - Focused diagnostic visual exams
  - Diagnosis or appropriate referrals



Assessment and Management of
Visual Dysfunction Associated with Mild Traumatic Brain Injury

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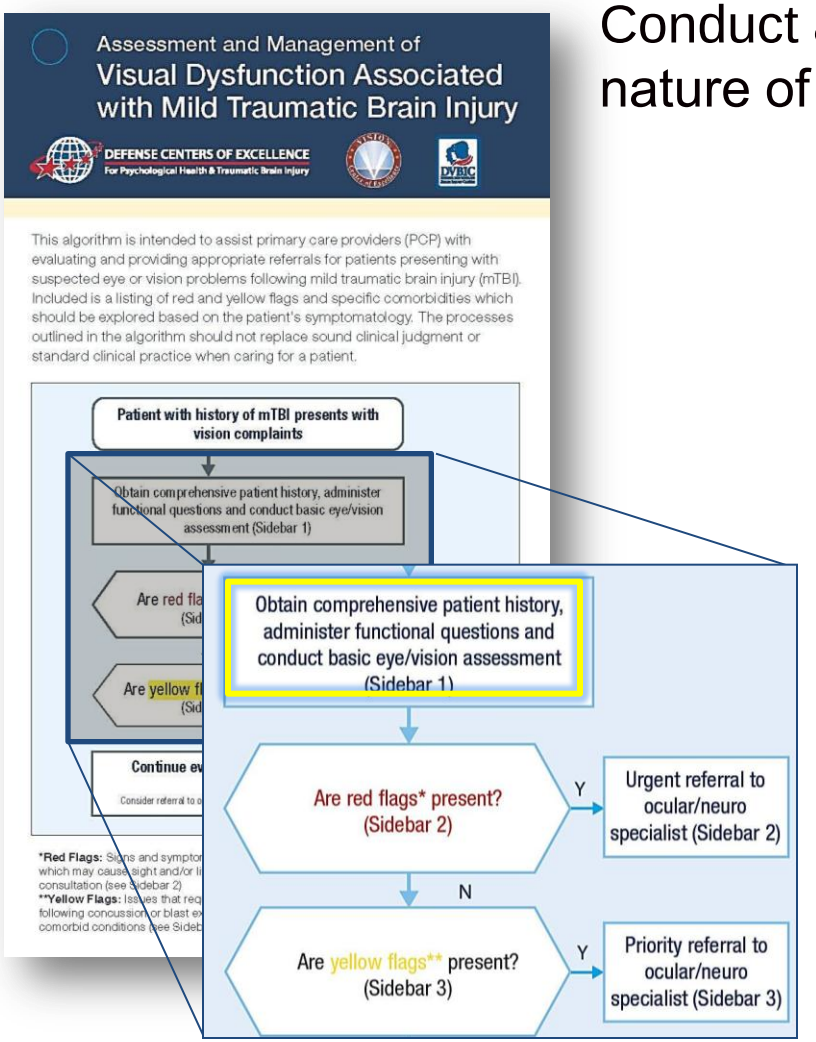
This algorithm is intended to assist primary care providers (PCP) with evaluating and providing appropriate referrals for patients presenting with suspected eye or vision problems following mild traumatic brain injury (mTBI). Included is a listing of red and yellow flags and specific comorbidities which should be explored based on the patient's symptomatology. The processes outlined in the algorithm should not replace sound clinical judgment or standard clinical practice when caring for a patient.

***Red Flags:** Signs and symptoms of potential ocular, cranial nerve or structural brain injury which may cause sight and/or life threatening outcomes, thus requiring urgent referral or consultation (see Sidebar 2)
****Yellow Flags:** Issues that require follow up. Common visual symptoms that may occur following concussion or blast exposure which may be related to trauma or premorbid/ comorbid conditions (see Sidebar 3)

Comprehensive Patient History



Conduct a thorough history to understand the nature of the patient's visual disturbance including:

- Concussion/mTBI history*
- Specific vision symptoms and their clinical course
- Mechanism(s) and details of injury/potential exposure
    - Blast, blunt, penetrating, sports, damage to eye glasses/protective equipment
- Associated injuries such as tympanic membrane rupture, facial lacerations or fractures
- Comorbidities and medications

* See VA/DoD Clinical Practice Guidelines for Management of Concussion/mTBI

Functional Vision Questions to Consider

Common questions to ask the patient when identifying certain vision problems that may be interfering with everyday activities such as:

Sidebar 1B

Functional Vision Questions to Consider

- **"Have you experienced any change in vision?"**
- "Do you ever experience blurred vision (far or near?)"
- **"Do you ever experience double vision?"**
- "Have you experienced any vision loss?"
- **"Do you ever experience sensitivity to light or glare?"**
- "Do you see equally with each eye?"
- **"Do you experience problems with balance or dizziness?"****
- "Do you have difficulty maintaining clear vision for extended time periods?"
- **"Do you have problems reading across a page or computer screen?"**
- "Do you get a headache when reading or using a computer?"
- **"Have you experienced any changes to visual habits such as cell phone/texting use, driving, video games, etc?"**
- "Do you see better if you tilt or turn your head?"
- **"When do you notice visual problems?"**
- "What were you doing when you noticed the visual problem?"

**See DCoE Clinical Recommendation for the Assessment and Management of Dizziness Associated with Mild TBI

- Blurred vision (far or near)
- Double vision
- Vision loss
- Sensitivity to light or glare
- Problems with balance or dizziness
- Maintaining clear vision for extended periods or noticeable changes when reading or using a computer
- Improvements when tilting or turning the head
- Timing of when the vision problem occurred and what activity is the patient doing at the time of symptom(s)

Basic Eye/Vision Assessment

This exam should be completed to identify any objective findings following the patient's history to reveal red or yellow flags needing urgent or priority attention and/or differential diagnoses for proper referral.

- Visual acuity (binocular/monocular exam for distance and near)
- Monocular confrontation fields
- Pupils (size/equality, response to direct light, swinging flashlight test)
- Eye movements (eye tracking horizontal and vertical)
- Nystagmus (primary position and gaze provoked)
- External exam (inspection, lid eversion for foreign body, direct illumination of anterior segment)
- Slit lamp (if available)

Sidebar 1C
Basic Eye/Vision Assessment

Basic Eye/Vision Assessment*	
Visual acuity	▪ Distance (right, left, together) ▪ Near card (right, left, together)
Monocular confrontation fields	▪ Four quadrant finger counting (each eye)
Pupils	▪ Size/equality ▪ Direct response to light ▪ Swinging flashlight test
Eye movements	▪ Eye tracking (horizontal and vertical)
Nystagmus	▪ Primary position ▪ Gaze evoked
External exam	▪ Inspection ▪ Consider lid eversion for foreign body sensation ▪ Direct illumination of anterior segment
Slit lamp exam	If available

*Optional PCP Oculomotor Dysfunction Assessment

Test	Result	Referral
Letter test at distance monocularly	Difficulty reading letters at 20/40 level	Optometry/ Ophthalmology
Cover/uncover test	Eye movement observed ***or*** patient reports target movement (vertical or diagonal only)	
Near letter test** monocularly	Difficulty reading letters at 20/40 level	
Near letter test** binocularly	Difficulty reading letters at 20/40 level ***or*** monocular performance better than binocular	

** Perform near letter test at the standard distance of 40 cm (16 in) and consider moving the target up to 20 cm (8 in) to evaluate accommodative amplitude on patients under age 40

Red Flags

Sidebar 2
Red Flags and Referral to Specialist

Red Flag	Specific Red Flags	Referral (Facility-specific)
Vision loss or decline	▪ Monocular/binocular ▪ Field loss/scotomas ▪ Transient	Ophthalmology/ Optometry
Diplopia	▪ Double vision	Ophthalmology/ Neurology/Optometry/ Neuro-ophthalmology
Abnormal pupils	▪ Anisocoria (non-physiologic) ▪ Afferent pupillary defect ▪ Impaired reactivity ▪ Irregular shape	Ophthalmology/ Neurology/Optometry/ Neuro-ophthalmology
Abnormal external exam	▪ Ptosis ▪ Proptosis ▪ Subconjunctival hemorrhage ▪ Hyphema ▪ Foreign body	Ophthalmology/ Optometry
Trauma	▪ Ocular (including eyelid) ▪ Facial ▪ Polytrauma/moderate-to-severe TBI	Neurosurgery/ Ophthalmology/Oral Surgery/Maxillofacial (Plastic) Surgery/ Otolaryngology/ Optometry
Abnormal eye movements	▪ Restricted gaze ▪ Uncoupled eye movements ▪ Nystagmus	Ophthalmology/ Neurology/Optometry/ Neuro-ophthalmology
Abnormal visual behavior	▪ Bumping into things ▪ Lack of visual recognition	Ophthalmology/ Neurology/Optometry
Acute ocular symptoms	▪ Severe eye pain ▪ Flashes and/or floaters ▪ Severe photophobia	Ophthalmology/ Optometry

Observation of the following **red flags** requires urgent referral to an appropriate specialist:

- Vision loss or decline
- Diplopia
- Abnormal pupils
- Abnormal external exam
- Trauma
- Abnormal eye movements
- Abnormal visual behavior
- Acute ocular symptoms

Note: Facility and community capabilities will impact the optimal referral decision by the provider.

Yellow Flags

Sidebar 3
Yellow Flags and Referral to Specialist

Yellow Flag	Specific Yellow Flags	Referral (Facility-specific)
Visual dysfunction	▪ Eyestrain, blurred vision, difficulty focusing, ocular fatigue, difficulty reading, impaired depth perception ▪ Problem with sustained vision tasks ▪ Photophobia without associated headache ▪ Color deficit	Optometry/ Ophthalmology
Neurologic symptoms	▪ Uncontrolled headache with photophobia ▪ Dizziness/vertigo ▪ Visual neglect (right- or left-sided)	Neurology/ Neuro-ophthalmology
Physical exam finding	▪ Abnormal head posture/eye alignment or head turn (possibly compensating for visual problems)	Optometry/ Ophthalmology/ Neurology/ Neuro-ophthalmology

Sidebar 4
Continued Evaluation and Comorbidities

Comorbidities	▪ Migraine ▪ Sleep disturbance ▪ Chronic pain ▪ Additional injuries/illnesses ▪ Medication side effects/drug interactions ▪ Mood disorders ▪ Posttraumatic stress disorder (PTSD)
Medications	Evaluate

Observation of the following **yellow flags** requires a non-urgent specialty referral:

- Visual dysfunction
  Examples: eyestrain, blurred vision, trouble with focusing, reading or with depth perception, photophobia without associated headache, color deficit
- Neurologic symptoms
  Examples: uncontrolled headache with photophobia, dizziness/vertigo, visual neglect
- Physical exam finding
  Examples: abnormal head posture/eye alignment or head turn

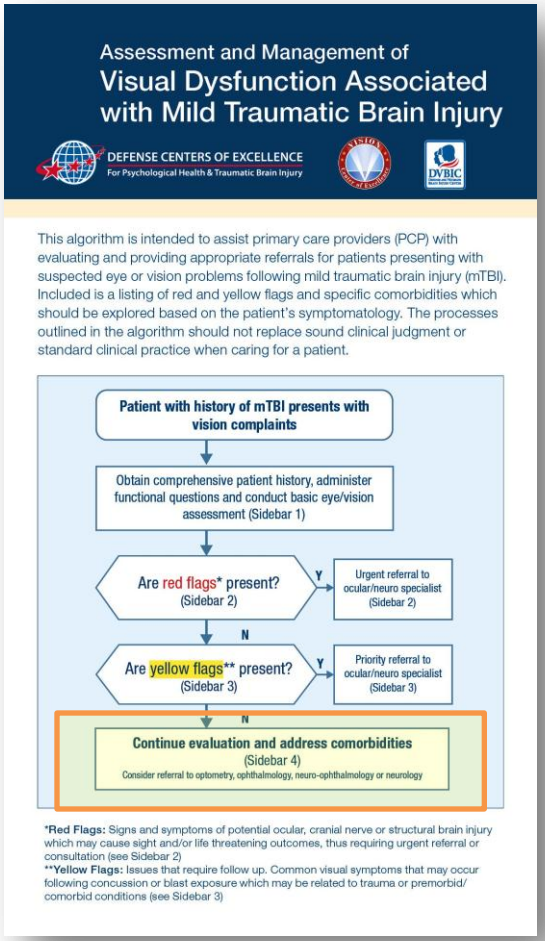
Note: Facility and community capabilities will impact the optimal referral decision by the provider.

Comorbidities

If NO red or yellow flags are present, continue the evaluation by ruling out comorbidities causing the vision complaints.

Sidebar 4
Continued Evaluation and Comorbidities

Comorbidities	▪ Migraine ▪ Sleep disturbance ▪ Chronic pain ▪ Additional injuries/illnesses ▪ Medication side effects/drug interactions ▪ Mood disorders ▪ Posttraumatic stress disorder (PTSD)
Medications	Evaluate



Evaluate Medications

A list of the patient's current medications should be evaluated as they may play a role in the patient's visual changes

Examples of **most common** drugs include:

- Antihistamines
- Anticholinergics
- Digitalis derivatives
- Antimalarial drugs
- Corticosteroids
- Erectile dysfunction drugs
- Phenothiazenes
- Thorazine
- Indomethacin

Sidebar 4

Continued Evaluation and Comorbidities

Comorbidities	▪ Migraine ▪ Sleep disturbance ▪ Chronic pain ▪ Additional injuries/illnesses ▪ Medication side effects/drug interactions ▪ Mood disorders ▪ Posttraumatic stress disorder (PTSD)
Medications	Evaluate

Patient Education

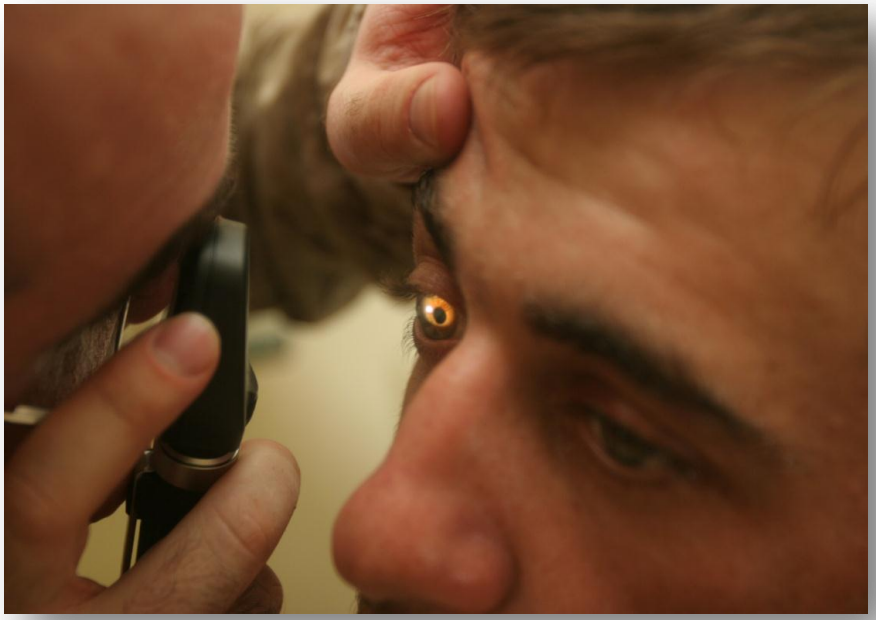
Instruct the patient to:

- Report any vision changes immediately for further evaluation
- Wear prescription glasses or sunglasses as directed
- Take breaks from reading or computer screen to avoid eyestrain
- Take medications as directed and report any side effects immediately

Non-urgent Referrals

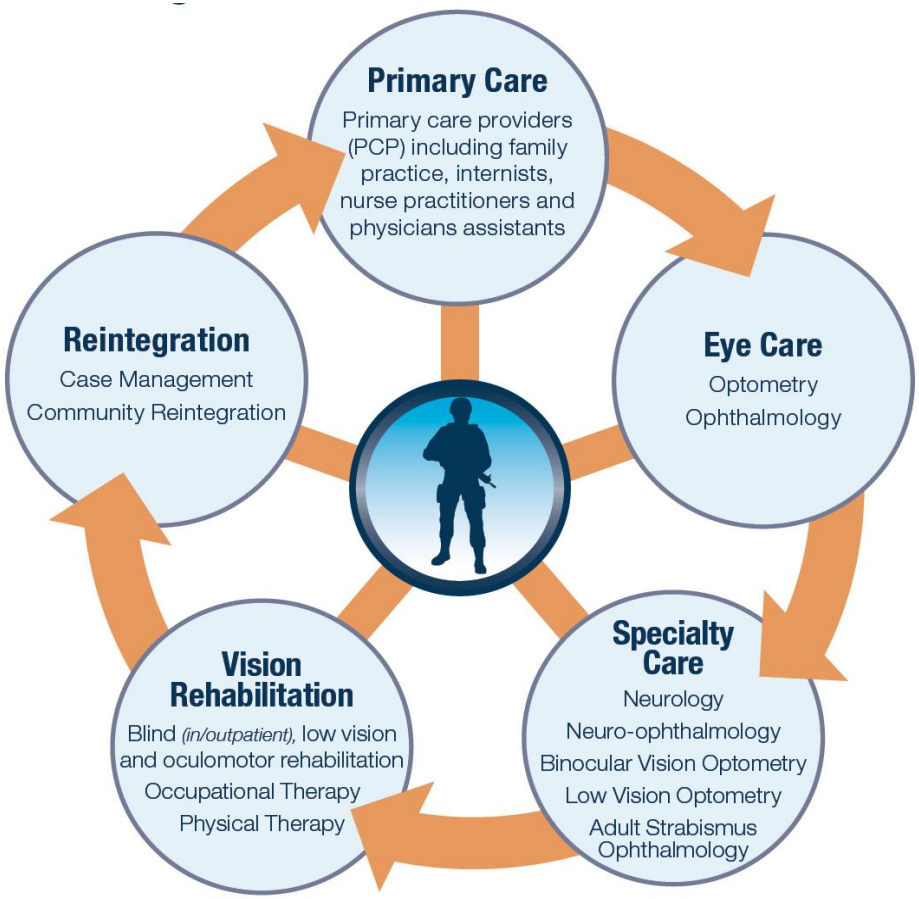
For all non-urgent cases, consider routine referrals to:

- Optometry
- Ophthalmology
- Neurology
- Neuro-opthalmology



Source: dvids.com

Continuum of Care for Visual Dysfunction Following TBI



Summary

- Two common types of visual dysfunction include oculomotor dysfunction and visual field loss

- Overview of assessment and management of visual dysfunction associated with mTBI:

  - Obtain comprehensive patient history, administer functional questions, and conduct basic eye/vision assessments
  - Assess for red flags and yellow flags
  - Provide appropriate specialty referrals including:
    - Optometry
    - Ophthalmology
    - Neurology
    - Neuro-opthalmology

Case Study

Visual Dysfunction Case Study

While deployed in Afghanistan, SPC Kaz hit his head on a blunt object, lost consciousness for the approximately one minute, and was subsequently diagnosed with a concussion. He complained of a headache, dizziness, and blurred vision immediately following the injury.

Horizontal nystagmus is present upon evaluation by the primary care provider during which time SPC Kaz also complains of worsening blurred vision to his right eye at far distances. Current medications include Trazodone at bedtime for sleep and Mefloquine.

Visual Dysfunction Case Study

Pertinent findings after exam and CT scan include:

- Normal head CT
- Visual Acuity: 20/20 both eyes with standard Snellen chart
- Letter test at distance monocularly:
  - 20/20 left eye
  - 20/60 right eye
- Extraocular movements: horizontal nystagmus
- Visual fields: right homonymous hemianopsia

Visual Dysfunction Case Study

Based on the pertinent findings, SPC Kaz was diagnosed with oculomotor dysfunction secondary to concussion. His presentation of horizontal nystagmus and homonymous hemianopsia (red flags) required an urgent referral to a specialist (Optometry, Ophthalmology, Neurology, Neuro-Ophthalmology).

He was provided education on the management of his visual dysfunction and headaches. Provider initiates tapering patient off of Trazodone due to its side effects. In addition, patient was given Naprosyn for headaches.

Knowledge Test

Question 1:

Trazodone and Mefloquine may be contributing to SPC Kaz's visual changes.

A. True
B. False

Answer: A: During his primary care visit, the provider reported that SPC Kaz is also taking mefloquine, a type of antimalarial drug that is known to contribute to vision problems. Trazodone is also known to cause blurred vision.

Knowledge Test

Question 2:

Based on SPC Kaz's primary care examination, what clinical finding warranted an urgent referral?

a)Positive Tandem Romberg

b)Normal visual acuity

c)Visual field loss

d)Nystagmus

e)Both C and D

Answer: E. SPC Kaz presented with visual field loss and nystagmus, which warranted an urgent referral to a specialist in Optometry, Ophthalmology, Neurology, or Neuro-Ophthalmology.

Knowledge Test

Question 3:

In the case of SPC Kaz, what other co-morbidities could possibly mask visual dysfunction following his mTBI?

a) Sleep disturbance
b) Headache
c) Medication side effects/drug interactions
d) Mood disorders
e) All of the above

Answer: E: Assuming that he was taking trazodone for a mood disorder or sleep, taking antimalarial medication, and complaining of posttraumatic headaches, the provider should be aware of and continue to evaluate him for comorbid conditions following his mTBI.

Knowledge Test

Question 4:

After the provider completes the history and functional questions, what should the provider do next?

a) Assess for red flags
b) Assess for yellow flags
c) Conduct a basic eye/vision assessment
d) Refer immediately to a specialist
e) None of the above

Answer: C: Conducting a basic eye/vision assessment to include visual acuity, monocular confrontation fields, pupils, eye movements, nystagmus, external exam, and slit lamp (optional) is completed.

Knowledge Test

Question 5:

All of the following are red flags that would have necessitating urgent referral to an ocular or neuro specialist except:

a) Diplopia
b) Facial trauma
c) Severe eye pain
d) Abnormal pupils
e) Impaired depth perception

Answer: E: All listed are red flags that require an urgent referral except for impaired depth perception, a yellow flag.