



Materials for referring providers with patients who are post-concussion greater than 3 months and less than one year

1. **Early cardio exercise is important in recovery from head injuries.** Usually 20 minutes with a heart rate greater than 120 (depending on age) at least every other day.
2. Give a positive outlook to the patient. Most patients recover within 2 weeks if they exercise early. Symptom exacerbation is not harmful and is a usual response to treatments.
3. Neuro-optometry clearance for smooth pursuit and convergence (ocular-motor) should be assessed. – Can be managed by occupational therapist or optometrist.
4. Vestibular-balance assessment. – Can be managed by vestibular therapist.
5. Patient may need referrals to:
 - Headache Clinic
 - Sleep Clinic
 - Cervical Neck PT
 - Psychiatry
 - Neuropsychology
6. If concussion symptoms continue after one year, patient can be referred to Stanford's General Neurology team for further workup and management.



Classification and management of concussion subtypes

We now know that there are certain impairments (subtypes) that concussion patients have which can be treated. These subtypes frequently occur together. Frequently we find that impairments in subtypes 1, 2, or 3 cause symptoms, and when they are corrected, the symptoms resolve. They may have some symptoms that are from before the concussion that were not recognized. **Early cardio exercise and a positive outlook expedites recovery.**

1. Eye movement impairments

Symptoms

- Can't focus on moving objects or objects moving toward you
- Fatigue with reading

*Prescription: Dynamic vision therapy with optometrist or occupational therapist

2. Vestibular/balance impairment

Symptoms

- Get dizzy when moving or turning
- Head movements cause symptoms including balance issues

*Prescription: Vestibular physical therapy

3. Neck Strain

Symptoms

- Moving and palpation of neck causes symptoms

*Prescription: Cervical neck physical therapy

4. Sleep

Symptoms

- Trouble going to sleep or waking up frequently during the night
- Fatigue during the day
- May have a preexisting sleep problem such as sleep apnea

*Prescription: Resolves with improvement in 1, 2, or 3, or may require a sleep medicine expert consultation

5. Migraines

Symptoms

- Light and/or noise sensitivity associated with headaches
(May have prior migraine history)

*Prescription: Usually resolves with improvement in 1, 2, or 3, but may need Headache Clinic referral (Neurology)

6. Anxiety/Depression

Symptoms

- Anxious and/or depressed
- Can occur with long standing concussion impairments
(May have prior history of anxiety or depression)

*Prescription: Psychiatrist or psychologist

Note: Most of these impairments can cause cognitive fatigue so patients may be referred for a neuropsychological evaluation.



Patient Material

How do we treat concussions?

1. Engage in Cardio activity

Begin with Moderate Intensity Cardio asap following injury. Stationary bike is best at first, and then advance to other exercises as vestibular and balance impairments resolve. Worsening of symptoms is not harmful, and is a normal response to treatments.

At least 4 x a week for 20-30 minutes. **Target Heart Rate for Aerobic Intensity**

Age Range	Heart Rate
18-24	118-121
25-34	112-117
35-44	106-111
45-54	100-105
55-64	94-99
65+	Min 93

2. Improve sleep quality

Strategies to maximize good quality sleep and promote overall cognitive efficiency and recovery

- A. Establish a sleep schedule. Go to bed at the same time each night. Get up at the same time each morning, regardless of when you fell asleep. Keep the schedule consistent, whether it's a weekday or weekend.
- B. Avoid excessive exposure to light immediately prior to bed: bright lights in the bedroom, tablets, smartphones, TV, etc.
- C. Establish a calming pre-sleep routine (i.e. take a bath, practice relaxation exercises, read a book outside of your bedroom).
- D. The bed should be reserved only for sleep and sexual activity -- not TV, work, or dealing with stressful topics. Bedroom should be quiet, dark, and cool (60-75F).
- E. Nicotine, caffeine, and alcohol all negatively impact sleep, more so the closer they are consumed to bedtime.
- F. Avoid daytime naps. At night, if unable to fall asleep for 20 minutes, get out of bed, do something relaxing, and then return to bed.
- G. Get daily exercise, but avoid high impact exercise in the late evening. Increase your fluid intake. Eat lighter meals in the evening.
- H. Treat any underlying disorders that may be associated with sleep changes: lung disease, sleep apnea, heart failure, anxiety, depression.

3. Mood management

Mood changes are common after a concussion. Here are a few ways to address the changes:

- Consult with a physician for a referral to a psychologist or psychiatrist, if needed
- Track your mood and identify triggers that worsen mood
- Pace yourself. Schedule challenging tasks at a time when you feel that you are most efficient (e.g., mornings), and give yourself plenty of time to complete the tasks
- Practice relaxation strategies (i.e. deep breathing, visual imagery, muscle relaxation) to reduce day-to-day stress



Patient Information: Concussion & Post-concussion Syndrome

What is a concussion?

A concussion is a change in brain function that can happen after a person is hit on the head, face, or neck, or their head or upper body is shaken too hard. Sometimes people pass out (lose consciousness), but not always. Common causes include sports injuries, car accidents, falls, and assaults.

What are the early symptoms of a concussion?

Symptoms that can happen minutes to hours after a concussion include:

- Memory loss – People sometimes forget what caused their injury, as well as what happened right before and/or after the injury
- Headache
- Dizziness or trouble with balance
- Nausea
- Vision problems
- Feeling sleepy, sleeping a lot, or not sleeping well
- Confusion, cranky, strange behavior, or not feeling like yourself
- Feeling in a fog, dazed, or out of sync

What is post-concussion syndrome?

Post-concussion syndrome is prolonged concussion symptoms that occur weeks to months after a concussion.

What are the symptoms of post-concussion syndrome?

- Headaches: including migraines, sensitivity to lights, noise;
- Dizziness;
- Difficulty reading, tracking moving objects;
- Cognitive changes: poor concentration, attention, memory;
- Sleep changes: fatigue, insomnia, or waking up frequently;
- Mood changes: irritability, depression, anxiety;

Will I need tests?

Your doctor should be able to tell if you have post-concussion syndrome by learning about your symptoms and doing dynamic vision testing, vestibular/balance testing, and a neurological exam. Depending on your case, you might have further tests.

How long will recovery take?

For many, symptoms improve within a few weeks. For others, especially those with a history of multiple concussions, or prior conditions such as migraine, anxiety/depression, ADHD, or neck strain, it may take many months, with some residual symptoms (like headaches, mood, or sleep disturbances) lasting longer. Most of these symptoms are treatable. The treatments are different depending on which symptoms are most active.

Here are some tips that some of my other concussion patients have found helpful:

- While still recovering from a concussion, avoid activities with high-risk for injury. Attention is impaired after a concussion, so you are at higher risk for another injury. Certain mental activities that require concentration, reading, or computer/phone screen usage will be impaired due to attention difficulty.
- Eat healthy meals, at regular times, and don't forget to hydrate.
- **** Early cardio exercise has been shown to shorten recovery time. ****
- There is no evidence that certain foods or supplements improve recovery.
- There is NO evidence showing that specific mental exercises (brainteasers, crosswords, puzzles) improves long-term brain function in domains other than the ones specifically exercised.

How can I prevent another concussion?

- Wear a helmet when you ride a bike or motorcycle or play contact sports.
- Wear a seat belt when you drive or ride in a car.
- Make sure you have good attention when doing activities that are potentially injurious. Sleep, nutrition/hydration, and cardio activity all contribute to good attention.

[Adapted from the Stanford Concussion and Brain Performance Center and UpToDate.com patient information materials]



Template to use for evaluating patients with possible post-concussion syndrome:

Concussion Clinic Documentation Form

Date of concussion:

Description of injury:

PTA: Yes or No

LOC: Yes or No

Symptoms following event: Headache, dizziness, concentration, nausea, fatigue, noise/light sensitivity, confusion, memory, mood changes/irritability, anxiety, depression, neck pain

Symptoms now: Headache, dizziness, concentration, nausea, fatigue, noise/light sensitivity, confusion, memory, mood changes/irritability, anxiety, depression, neck pain

Job or school:

Are symptoms interfering with tasks/performance: Yes or No

History of depression or anxiety: Yes or No

Work/School:

Past concussions: Yes or No. How many and when?

If yes, how long did it take to recover from the last concussion?

Sleep before concussion:

How many hours:

Rested in AM: Yes or No

Naps during the day: Yes or No

Do you wake up at night: Yes or No

Sleep after concussion:

How many hours:

Rested in AM: Yes or No

Naps during the day: Yes or No

Do you wake up at night: Yes or No

History of sleep apnea: Yes or No

Exercise before concussion:

Exercise after concussion:

Headaches/Migraines before concussion:

History: Yes or No

Family history: Yes or No

Headaches/Migraines after concussion:

Yes or No

Medications:

Motion sickness before concussion:

Yes or No

Motion sickness after concussion:

Yes or No

Exam:

Neck pain: Yes or no

Abnormal findings with exam:

Convergence impairments:

Yes or No

No

Vestibular impairments (Dizzy, Headache, nauseous, Foggy):

Horizontal: Yes or No

Vertical: Yes or

OK to Drive? Yes or No

Referrals to:

PT for vestibular training Sleep Clinic

Neuropsychology

ENT

SLP

Cervical PT

Referral to OT for driving assessment/return to work/vision therapy

Headache Clinic

Links and papers which can help with better understanding of post-concussion assessment and treatment

Review of Vestibular and Oculomotor Screening and Concussion Rehabilitation

Anthony P. Kontos, PhD; Jamie McAllister Deitrick, PhD;

Michael W. Collins, PhD; Anne Mucha, DPT

Journal of Athletic Training 2017;52(3):256–261

Concussion Guidelines Step 2: Evidence for Subtype Classification

Neurosurgery in Press 2019

VOMS Video: https://www.youtube.com/watch?v=XIA_wJAMBmg

Vestibular/Ocular-Motor Screening (VOMS)

Smooth Pursuits (Horizontal & Vertical)

Tests ability to follow a slowly moving target

Both patient and clinician are seated
Patient follows finger with eyes
Do NOT move head, just eyes
2 reps at rate of 2 sec / rep
Rate symptoms (0-10)
Complete for both horizontal & vertical

Saccades (Horizontal & Vertical)

Tests ability of eyes to move quickly between targets

Both patient and clinician are seated
Clinician holds fingers 3' apart
Patient initially looks L-R
Do NOT move head, just eyes
10 reps as quickly as possible
Rate symptoms (0-10)
Repeat with patient looking Up-Down

Convergence

Measures ability to view a near target without double vision

Patient holds target with 14-point font "X" at arms length
Patient brings target toward eyes focusing on the "X"
Stop when they see double
Clinician measures distance from tip of nose to target (cm)
Repeat 3x; record all 3
Rate symptoms (0-10)

Visual Motion Sensitivity

Tests visual motion sensitivity & ability to inhibit vestibular induced eye movements using vision

Patient holds arm outstretched in front with thumb up
Turn body as a unit to L-R 90 deg from midline focusing on thumb
Use metronome 50 bpm
Repeat 5 revolutions
Rate symptoms (0-10)

Vestibular-Ocular Reflex (Horizontal & Vertical)

Assess ability to stabilize vision as head moves

Clinician holds target 3' from patient's eye level
Patient initially turns head L-R 10x
Keep eyes focused on target
Use metronome 100 bpm
Wait 10 seconds
Rate symptoms (0-10)
Repeat with patient looking Up-Down

Visit natafoundation.org/for-the-profession for more info including the NATA Foundation e-article on VOMS

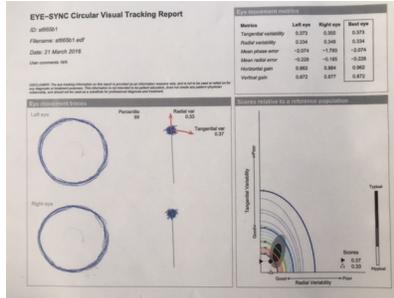
- Collins MW, Kontos AP, Reynolds E, et al. A comprehensive, targeted approach to the clinical care of athletes following sport-related concussion. *Knee Surg Sports Traumatol Arthrosc.* 2014;22:235-246.
- Khan S, Chang R. Anatomy of the vestibular system: a review. *Neurorehabilitation.* 2013;32:437-443.
- Kontos AP, Sutinjo A, Elbin RJ, Puskas A, Collins MW. Reliability and associated risk factors for performance on the vestibular/ocular motor screening (VOMS) test in healthy collegiate athletes. *Am J Sports Med.* 2014;44:1403-1408.
- Mucha A, Collins MW, et al. A brief vestibular/ocular motor screening (VOMS) assessment to evaluate concussions: preliminary findings. *Am J Sports Med.* 2014;42:2479-2486.



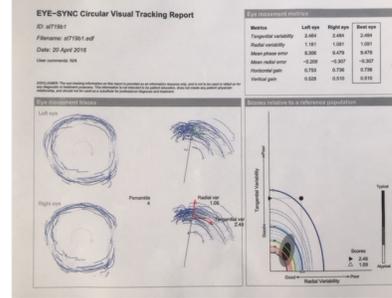
Examples of eye tracking and vestibular-ocular impairments (may occur separately or together).

1. Smooth pursuit impairment: Forward saccades during smooth pursuit with increased position variability.

Normal



Abnormal



2. Convergence insufficiency: seeing double more than 6 cm from their nose.
2. Vestibular-ocular impairment: impaired eye-target fixation during horizontal or vertical vestibular-ocular reflex producing symptoms of headache, dizziness, fogginess, or dazed.

Normal

(Eye positions compared to target)

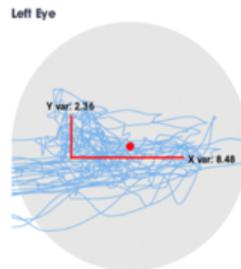
VOR Horizontal



Abnormal

(Eye positions compared to target)

VOR Horizontal



3. Vestibular Ocular Motor Screening can be used.

Benefits of early exercise after concussion

Benefits of Strict Rest After Acute Concussion: A Randomized Controlled Trial

Danny George Thomas, MD, MPH, Jennifer N. Apps, PhD, Raymond G. Hoffmann, PhD, Michael McCrea, PhD, Thomas Hammeke, PhD
PEDIATRICS Volume 135, number 2, February 2015

The Effect of Physical Exercise After a Concussion

A Systematic Review and Meta-analysis
Avtar Lal, MD, PhD, Stephanie A. Kolakowsky-Hayner, PhD, Jamshid Ghajar, MD, PhD, and Maya Balamane, MPH
The American Journal of Sports Medicine
AJSM Vol. 46, No. 3, 2018

Stanford Brain Performance Center