Advanced Concepts: Office-Based Follow-Up and Concussion Management

Michael Petrizzi, MD, FAAFP
Steven L. Cole, MEd, ATC

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Michael Petrizzi, MD, FAAFP

Clinical Professor, Department of Family Medicine and Population Health, Virginia Commonwealth University (VCU), Richmond; Private Practice Physician, Hanover Family Physicians, Mechanicsville, Virginia; Team Physician, Atlee High School, Mechanicsville; Volunteer Physician, VCU Athletics, Richmond; Faculty, National Procedures Institute

Dr. Petrizzi is a graduate of the medical college at State University of New York (SUNY) Downstate Medical Center. He completed his family medicine residency at the University of North Carolina (UNC) at Chapel Hill, as well as a fellowship. Dr. Petrizzi practices full-spectrum family medicine, from newborn to nursing home, with a sports medicine concentration. He is the recipient of the SUNY Downstate Medical Center’s George Liberman, MD, Award in Family Practice for excellence in family medicine teaching and has served on the Virginia Department of Education Policy on Concussion for Student Athletes subcommittee. As part of his passion for caring for high school athletes, he continues to serve on the Virginia High School League Sports Medicine Advisory Committee and is the Atlee High School team physician. He is the co-developer of the Sideline Management Assessment Response Techniques (SMART) workshop, designed to appropriately evaluate and manage injuries on the athletic field and sidelines. He has authored or edited numerous articles and books about sports medicine. This will be his 26th year presenting at FMX, specializing in field-side management, casting and splinting, exam techniques, and joint injections.
Steven L. Cole, MEd, ATC

Cole Consulting Services, Inc., Williamsburg, Virginia

Cole earned his undergraduate degree from West Virginia University in Morgantown and his master's degree from the University of Virginia. He has more than 40 years of health care and athletic administration experience, with more than 35 years of experience at the collegiate level. Prior to taking over the day-to-day operation of the College of William & Mary's Athletics Department as the Associate Athletics Director, he led the college's sports medicine program for 26 years as the Director of Sports Medicine. For the past 28 years, he has coordinated the Performing Arts Sports Medicine Program for Busch Entertainment Corporation in Williamsburg, Virginia. He has also served as the affiliated clinical site coordinator for Riverside Family Medicine Residency in Newport News, Virginia, and as a clinical instructor for the post-professional Athletic Training Program at Old Dominion University in Norfolk, Virginia.

As the principal agent for Cole Consultant Services, Inc., Cole works with numerous athletic programs, medical practices, and industrial corporations. He is approved by the Board of Certification for the Athletic Trainer (BOC) as a provider for continuing educational programs for athletic trainers. For more than 35 years, he has conducted workshops on sports medicine topics for high school students, coaches, athletic trainers, physical therapists, and physicians. Notably, he co-developed the SMART (Sideline Management Assessment Response Techniques) workshop for primary care physicians to enhance their sports medicine skills and increase their confidence and competence as sideline physicians at sporting events. Cole has written clinical skills curricula for primary care physicians and published several articles relevant to athletic health care and the administration of health care programs. In addition, he is one of the authors of a book on the assessment of athletic training practical skills. A competitive age-group triathlete and experienced personal fitness consultant, Cole is also a nationally recognized expert on preparing athletic training students for their national certification boards, managing athletic injury insurance programs, and teaching on-field injury management skills to primary care physicians.

Learning Objectives

1. Use the current tools available to appropriately evaluate a concussion.

2. Treat a concussion while symptomatic and how to guide a return to academic and athletic activities.

3. Identify and manage complications associated with sports related concussion or post-concussion syndrome.
Additional Educational Objectives

- Understand the various components of Post Concussion Disorder (PCD)
- Know how to use rehabilitation exercises appropriately treat a patient with **Persistent Post Concussion Disorder (PPCD)** symptoms
  - Convergence deficits
  - Gaze Stabilization abnormality
  - Visual Motion Sensitivity
What is a concussion?

• Definition:
  • a complex *pathophysiologic process* affecting the brain, induced by traumatic biochemical forces secondary to direct or indirect forces to the head.
  • Translation:

    Brain goes into **panic** mode after it gets jostled around; functional injury, not structural

Is it a concussion?

• Look for three things:

  1. Check for signs and symptoms
     • Physical, cognitive, emotional and sleep
  2. Check for physical exam findings that are specific to a concussion
     • Cognitive problems
     • Coordination problems
  3. Look for “Bonus Prizes”
     • Think Locally/Regionally/Globally
       • Be suspicious with any head or neck injury (broken nose, bleeding lip)
     • It’s not what you think it is, it’s what you know it’s not

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Mild</th>
<th>Mod</th>
<th>Sev.</th>
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<tbody>
<tr>
<td>Headache</td>
<td>0</td>
<td>1 2</td>
<td>3 4 5 6</td>
</tr>
<tr>
<td>Head pressure</td>
<td>0</td>
<td>1 2 3 4</td>
<td>5 6</td>
</tr>
<tr>
<td>Neck pain</td>
<td>0</td>
<td>1 2 3 4</td>
<td>5 6</td>
</tr>
<tr>
<td>Nausea/Vomiting</td>
<td>0</td>
<td>1 2 3 4</td>
<td>5 6</td>
</tr>
<tr>
<td>Dizziness</td>
<td>0</td>
<td>1 2 3 4</td>
<td>5 6</td>
</tr>
<tr>
<td>Blurred vision</td>
<td>0</td>
<td>1 2 3 4</td>
<td>5 6</td>
</tr>
<tr>
<td>Balance problems</td>
<td>0</td>
<td>1 2 3 4 5</td>
<td>6</td>
</tr>
<tr>
<td>Sensitivity to light</td>
<td>0</td>
<td>1 2 3 4</td>
<td>5 6</td>
</tr>
<tr>
<td>Sensitivity to noise</td>
<td>0</td>
<td>1 2 3 4</td>
<td>5 6</td>
</tr>
<tr>
<td>Feeling dazed down</td>
<td>0</td>
<td>1 2 3 4</td>
<td>5 6</td>
</tr>
<tr>
<td>Feeling “in a fog”</td>
<td>0</td>
<td>1 2 3 4</td>
<td>5 6</td>
</tr>
<tr>
<td>“Doesn’t feel right”</td>
<td>0</td>
<td>1 2 3 4</td>
<td>5 6</td>
</tr>
<tr>
<td>Difficulty concentrating</td>
<td>0</td>
<td>1 2 3 4</td>
<td>5 6</td>
</tr>
<tr>
<td>Difficulty remembering</td>
<td>0</td>
<td>1 2 3 4</td>
<td>5 6</td>
</tr>
<tr>
<td>Fatigue or low energy</td>
<td>0</td>
<td>1 2 3 4</td>
<td>5 6</td>
</tr>
<tr>
<td>Confusion</td>
<td>0</td>
<td>1 2 3 4</td>
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<td>Memory loss</td>
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<tr>
<td>Fatigue</td>
<td>0</td>
<td>1 2 3 4</td>
<td>5 6</td>
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<tr>
<td>Nervous or Anxious</td>
<td>0</td>
<td>1 2 3 4</td>
<td>5 6</td>
</tr>
<tr>
<td>Trouble falling asleep</td>
<td>0</td>
<td>1 2 3 4</td>
<td>5 6</td>
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</tbody>
</table>

**Symptom severity score of 137**

<table>
<thead>
<tr>
<th>Symptoms worsened with physical activity</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symptoms worsened with mental activity</td>
<td>Yes</td>
<td>No</td>
</tr>
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</table>
Concussion Recovery

- General Recover Time
  - Cognitive & Physical rest
    - Remove aggravating stimulus
    - Allow brain’s physiology & function to return to normal
  - Adults: 7 to 10 days
  - Child: 10 to 14 days or longer

- Persistent Post Concussion Symptoms
  - Symptoms greater than 3 weeks

Returning to Participation Protocol

<table>
<thead>
<tr>
<th>Rehabilitation Stage</th>
<th>Functional Exercise</th>
<th>Objective</th>
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</thead>
<tbody>
<tr>
<td>1. Rest until asymptomatic</td>
<td>Complete physical and cognitive rest</td>
<td>Recovery</td>
</tr>
<tr>
<td>2. Light aerobic activity</td>
<td>Walking, swimming, stationary cycling. Mild intensity</td>
<td>Increase HR</td>
</tr>
<tr>
<td>3. Sport-specific activity</td>
<td>Running or skating drills. No head impact activities</td>
<td>Add movement</td>
</tr>
<tr>
<td>4. Non-contact training drills</td>
<td>Progression to more complex training drills</td>
<td>Exercise, coordination, cognitive load</td>
</tr>
<tr>
<td>5. Full contact practice</td>
<td>Following medical clearance. Normal training activities</td>
<td>Restore confidence, assessment of functional skills by coaching staff</td>
</tr>
<tr>
<td>6. Return to play</td>
<td>Normal game play</td>
<td></td>
</tr>
</tbody>
</table>

Note: Once asymptomatic and Stage 1 has been completed, each subsequent step should take 24 hours (no accelerated “stages or days”)
Follow Up Evaluation of a Concussion

**Challenges**
- Symptoms change day to day
- Patient may ‘look good’ at rest but may not be completely resolved
- Athletes and their coaches are not always honest regarding symptoms

**Goals**
- Effectively evaluate signs and symptoms
- Detect any warning signs of a secondary and potentially more dangerous condition
- Provide management recommendations during the symptomatic period
- Accurately assess the resolution of the concussion
- Appropriately guide return to participation efforts
Concussion Management

Buffalo Concussion Treadmill Test (BCTT)

- Aid in differentiating between possible diagnoses for concussive symptoms (Cervicogenic injury, PCS, etc.) and etiology of the concussion.

- Investigate exercise tolerance in patients with post-concussive symptoms (PCS) lasting more than 3 weeks.

- Help establish appropriate levels of exercise to aid in Return to Play for concussed athletes and assist in treatment protocols.

- Identify physiological variables associated with exacerbation of symptoms, and the patient’s level of recovery.
Cerviogenic PCD

- Symptoms:
  - Headache
  - Neck Pain
  - Dizziness

- Treatment: Restoration of Cervical Spine ROM
  - Cervical Spine mobilization
  - Neck & Shoulder stretching
  - Scapular stabilization
  - Chin Tucks

Vestibular & Oculomotor Impairment

- The vestibular system defects motion of the head in time and space. The two primary functional aspects are:
  - Regulate postural stability
  - Integrates vision and movement of the head

- Impairment occurs in 60% of athletes after a SRC
  - 45% abnormal near-point convergence

- Evident only when provoked by stimuli or movement
- Worsen with reading or taking notes
- Patients with vestibular insufficiency initially more likely to exhibit protracted recovery
  - 59 days vs 6 days (Corwin et al., 2015)
Poll Question 1

The vestibular system defects motion of the head in time and space. The two primary functional aspects are:

a) Keeping a person’s head on straight
b) Regulate postural stability
c) Regulating a person’s field of vision
d) Integrates vision and movement of the head

Physical Exam-Vestibular Ocular Motor Evaluation

- “H” Test
  - Regular extra ocular range of motion
  - Take your time; go slow to see smoothness of motion; hold out at edges
  - Abnormal: jerky pursuit; Nystagmus at extremes of vision

- Saccades
  - Looking from fingertip to nose and back
  - Horizontal and Vertical
  - Abnormal: under shooting or over shooting

- Horizontal Gaze Stability
  - Keeping eyes fixed on nose, turn head back and forth
  - Abnormal: ‘hang time’ of eyes, nystagmus
  - Particularly look for worsening of symptoms
Vestibular & Oculomotor Impairments

- BPPV (Benign Paroxysmal Positional Vertigo)
- Balance dysfunction
- Exercise-induced dizziness
- Cervicogenic dizziness
- Vestibulo-ocular reflex (VOR) dysfunction
- Visual Dysfunction
  - Convergancy deficits
    - Present in 45% of patients with SRC
  - Gaze Stabilization abnormality
  - Visual Motion Sensitivity
Poll Question 2

Which of the following are common vestibular issues following a sport-related concussion (SRC):

a) Benign paroxysmal positional vertigo (BPPV)
b) Vestibulo-ocular reflex (VOR)
c) Visual motion sensitivity
d) Balance dysfunction
e) Cervicogenic dizziness
f) Exercise-induced dizziness
g) All of the above

Treatment for BPPV

THE EPLEY MANEUVER

Redistributed particles

Particles repositioned near canal

The head may be rapidly turned even further to accentuate the four:
The patient is turned to the side and the head is rotated back to normal.

The clinician raises the patient's head toward the affected ear, then slowly turns the patient into the affected ear side by side hanging over the table's edge.

The head is turned further, so that the ear is parallel to the floor.

The head is turned to the other side.

Self-treatment of benign positional vertigo (left)

Sitting or reclining on a bed with both feet off the floor.

Have a pillow behind you so that your back is at a slight angle.

Lie flat on your back with your knees bent and your feet hanging off the edge of the table.

Turn your head 45° to the right and hold for 30 seconds.

Turn your body and head another 45° to the right and hold for 30 seconds.

Repeat the process 3 times for both sides.

This maneuver should be carried out three times a day. Repeat this daily until you no longer have positional vertigo for 24 hours.
Balance Deficiencies

• Get Up & Go (TUG) Test

Grading Dizziness Symptoms

• 25-item self-report questionnaire
• Assesses effects of dizziness
  • Functional
  • Physical
  • Emotional
• Score greater than 10 indicates referral needed
Concussion Rehab

Principles of Concussion Rehabilitation

- Active, expose-recover approach
- Target & stress specific impairment & symptoms
- Symptom provocation used as a marker for tolerance of specific exercises
  - Some level of symptom provocation necessary to promote recovery
Poll Question 3

The principle for vestibular rehabilitation involve:

a) Total rest, physical & cognitive until the patient is asymptomatic
b) Active, expose-recovery approach
c) Gradual and systematic exposure to provocative stimuli
d) Total physical rest with a rapid return to cognitive activities

Concussion Rehabilitation Exercises

• Vestibulo-Ocular
  • Use your VOMS to guide your exercises
    • Specific tests for specific exercises
    • Metronome speeds
  • Saccades and Convergence
    • Primarily the ocular system
  • VOR
    • Combines ocular and vestibular system
• VMS
  • Assesses vestibular system
Rehabilitation for Vestibular-Ocular Post Concussion Disorder (PCD)

- Convergence deficits
  - Brock String test
  - Pencil Pushups
  - Brock String exercises

- Gaze Stabilization
  - Dynamic Visual Acuity Test (DVA)
  - VOR
    - VORx1
      - Stationary target, head moves
    - VORx2
      - Head & target move in opposite directions

Gaze Stability: Eye Tracking

Examination of eye movement

- Check in 9-cardinal position
Gaze Stabilization Training Progression

- **Patient Position**
  - Sitting
  - Standing

- **Head Movement**
  - Turn with pause
  - Turn back & forth

- **Speed of Head Movement**
  - Slow
  - Medium
  - Fast

- **Target Distance**
  - Near (1 foot)
  - Far (3 feet or greater)

- **Background**
  - Eyes closed
  - Blank background
  - Busy background (checkerboard)
  - Very busy background (grocery store)
  - Very busy moving background (crowds, watching waves, windy outdoors)
  - Misleading background (walking against crowd, twisting umbrella)

Dynamic Visual Acuity (DVA) Test

- **Patient sits** 10 feet from eye chart, wearing glasses if needed

- Static Assessment: patient reads lowest line recognizable on eye chart error free.

- Dynamic Assessment:
  - Examiner stands behind patient,
  - Flexed head to 30 degrees,
  - Oscillate head 20 to 30 degrees at 2 cycles per second.
  - Patient reads lowest line recognizable on eye chart error free.

- A loss of **two or more** lines is clinically significant.
Poll Question 4

45% of patients with a SRC experience which of the following?

a) BPPV
b) Abnormal near point convergence
c) Balance dysfunction
d) Cervicogenic dizziness

String Test: Convergence deficit

• 4 ft sting, knot in middle
• Make fist, dominate hand, measure from middle knuckle to elbow
  • This is correct reading distance
• Hold string at that point, put to nose
• Examiner holds other end
• Patient looks down string at knot
  • Should see two strings forming an “X” with knot in middle

Anything else indicates a convergence deficit
Pencil Push Ups

- Hold pencil @ arm’s length, tip up, just below eye level
- Move slowly towards face until you see two pencils
- Look away, re-focus on pencil to eliminate double vision
- Move pencil back out to arm’s length when able to rid double vision
  - If takes more then a few seconds, look away & try again
- Repeat for 10 minutes

Brock String Exercises

- Hold @ eye level, one end @ nose
  - Green bead @ 14 inches
  - Roughly normal reading distance
  - Yellow bead @ 30 inches
  - Red bead @ 5 feet
- Look down string @ yellow bead
  - When eyes in focus together should see one yellow, two green & two red beads.
  - If difficulty with focus, cover dominate eye, focus on yellow bead & slowly uncover eye until see one yellow, two green & two red beads.
Brock String Exercises

• Shift focus to **red** bead
  • When eyes in focus together should see one yellow, two green & two red beads.

• If difficulty with focus, cover dominate eye, focus on yellow bead & slowly uncover eye until see one red, two yellow & two green beads.

Brock String Exercises

• Shift focus to **green** bead (hardest to see)
  • When eyes in focus together should see one green, two yellow & two red beads.

• If difficulty with focus, cover dominate eye, focus on green bead & slowly uncover eye until see one green, two yellow & two red beads.

• Continue to move green bead closer to nose; **Goal**: 6 to 8 inches from nose
  • Between each move focus up & down sting at other beads.

• **Mastery**: Able to converge at each bead, even with green bead well within comfortable reading distance.
Practice Recommendations

- Implement a team approach utilizing various healthcare specialists
- Need to identify the specific Post Concussion Symptom/Disorder
  - Physiological
  - Vestibulo-Ocular
  - Cervicogenic
- Patients symptomatic after 3 weeks need to engage in symptom guided rehabilitation
  - Active, expose-recover approach

Summary

- Be though with your evaluations, objective over subjective information
  - Symptoms change day to day
  - Patient may ‘look good’ at rest but may not be completely resolved
  - Think Locally/Regionally/Globally
    - Be suspicious with any head or neck injury (broken nose, bleeding lip)
    - It’s not what you think it is, it’s what you know it’s not

- Rehabilitation utilizes an Active, expose-recover approach
  - Target & stress specific impairment & symptoms
  - Symptom provocation used as a marker for tolerance of specific exercises
    - Some level of symptom provocation necessary to promote recovery
Questions