

Objectives

Physical Therapy Intervention Following Concussion

Janet Callahan PT, DPT, MS, NCS



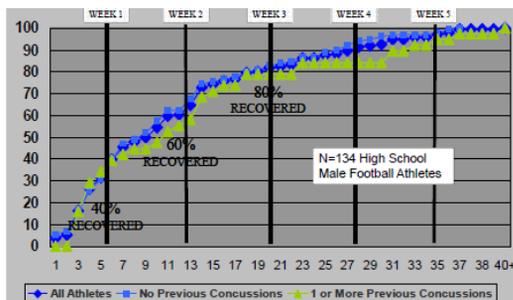
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- The learner will:
 - Be able to identify appropriate physical therapy interventions post concussion
 - Understand dosing parameters for physical therapy interventions in individuals post concussion
 - Understand the components of exertional training as they relate to individuals post concussion

Recovery



Collins et al, 2006

Sub-acute Symptoms Predicting Protracted Recovery

- Foggy feeling
- Difficulty concentrating
- Vomiting
- Dizziness



Lau, Lovell, Collins & Pardini 2009

Dizziness and Concussion

- Reported to occur in 23% to 81% of cases in the first days after injury
Alsalaheen et al, 2010
- 32% of 141 patients with mild TBI report dizziness after 5 years
Masson et al, 1996
- On-field dizziness is a predictor of protracted outcomes
Lau B et al, 2011

Lau B et al, 2011

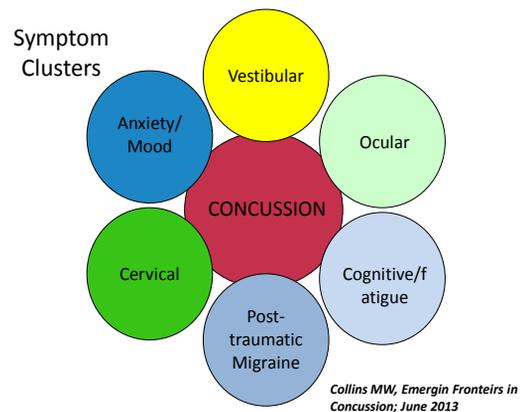
Risk Factors for Protracted Recovery

- Age - < 26 y.o
- Repetitive concussion
- Exertion
- Migraine history and symptoms
- Learning disability
- Gender – females do worse than males
- Genetics (?)

Lau, Lovell, Collins & Pardini 2009

Etiology of Dizziness

- Peripheral Vestibular Disorders
 - Benign Paroxysmal Positional Vertigo (<5%)
 - Labyrinthine Concussion
 - Temporal Bone Fracture (More likely in moderate to severe TBI)
 - Perilymphatic fistula
- Central Vestibular Disorders
 - Brainstem or Cerebellar
 - Migraine-Related
- Orthostatic Hypotension
- Ocular Motor Abnormalities
- Cervicogenic (Adapted from Furman 2010)



Physical Therapy Examination

- Vestibular Therapist
 - Oculomotor Control
 - Vestibular Function
 - Postural Control
- Orthopedic/CVP/Sports Therapist
 - Cervical Spine
 - Activity tolerance/Exertion

Physical Therapy Intervention

- Activity Modification/Patient education
- Vestibular Rehabilitation
- Postural Control Retraining
 - Sensory integration
 - Reduce visual over-reliance
 - Increase use of vestibular inputs
 - Cervical Spine Treatment
 - Joint Position Error (JPE)
 - Manual Therapy
- Exertional training



Activity Modification

- Monitor daily activities
- Journal baseline symptoms
- Journal response to activity



Physical Therapy Management Guidelines

- Begin **slowly**
- Monitor symptom response
 - Intensity (VAS)
 - Recovery time
- Progress **slowly**
- Monitor activity

Minimize Symptom Provocation

Vestibular Rehabilitation

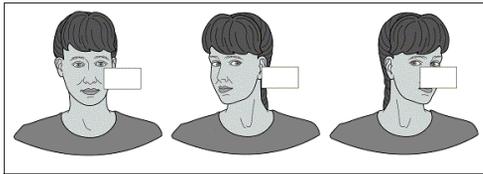
- Gaze stability exercise
 - Maintain visual fixation during movement of the head
- Oculomotor training exercises
 - Brock's string
- Sensory Integration exercises
 - Manipulate sensory inputs while challenging balance
- Space & Motion Sensitivity exercises
 - Graduated exposure to provocative stimuli

Vestibulo-Ocular Reflex Training (Gaze Stability Training)

- Maintain visual fixation during head movement
 - Direction of head movement
 - Speed of head movement
 - Posture
 - Target size



Adaptation Exercises Gaze Stability Exercises



- Place Target 2 ½ - 3' away or at optimal focal point
- Turn head side to side/up and down through a 30 to 40 degree arc
- Adjust head speed to maintain target as *clear and stable*

Adaptation Exercises: Gaze Stability Exercises

X1 viewing exercises:

Head moving while visually fixating on a stationary target

X2 viewing exercises:

Head moving while visually fixating on a moving target

Adaptation Exercises: X1 Viewing Exercises



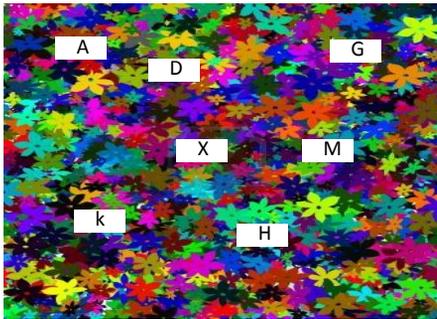
Adaptation Exercises: X2 Viewing Exercises



Progression of Gaze Stability Exercises

VARIABLE	PROGRESSION
Duration	10 reps → 30 reps
Frequency	2 → 3 times per day
Velocity	Increase head speed while keeping target in focus
Target Size	Large → Small
Target Distance	Near → Far
Background	Simple → Complex
Position of Patient	Supported sitting → Walking
Support Surface	Firm → Compliant Wide → Narrow BOS

Complex Background



Vestibular Hypofunction vs Concussion

- Concussion
 - Fewer repetitions
 - Reduced frequency
 - Monitor for onset of headache, foginess
 - Training for improved processing vs training for motor learning

Oculomotor Training

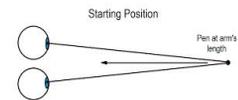
- Voluntary eye movements
- Vergence eye movements
- Refer to optometry/ophthalmology if not improving steadily



Convergence Exercises



BROCK'S STRING



PEN PUSH-UPS



CONVERGENCE DOT CARD

Sensory Integration Exercises and Balance Training



Amplitude of Head Movement



- Increasing amplitude of head movement integrating VOR with pursuit and saccades
- 4-5 repetitions at a time
- Allow recovery

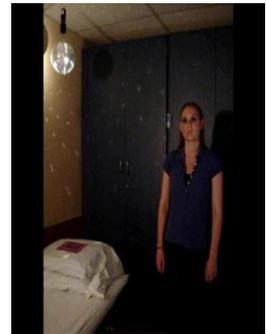
Higher Level Activities

- Integrate higher level balance exercises with head rotations
- Sport specific activities



Visual Motion Sensitivity training

- Gradual exposure to provocative stimuli
 - Light/Dark
 - Use of fixation point
 - Posture
 - Surface



Space and Motion Discomfort

- Graded habituation to increasingly complex environments
 - Visual Stimulation
 - Environmental Motion
 - Self motion



Cervical Spine

- Manual Therapy
 - Joint mobility
 - Soft tissue mobility
- Targeted Strength/ROM training
- Balance retraining
- Cervical Proprioception Training
- Oculomotor training

Cervical Position Sense Training



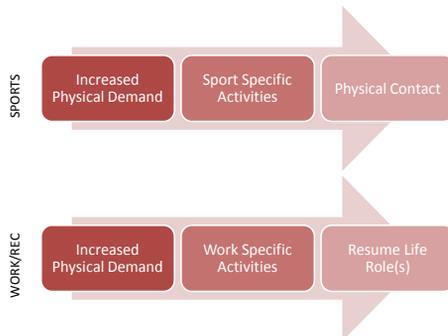
- Head mounted laser
- 35 inches from target
- ▶ Closes eyes, moves head maximally, then tries to return to center target
- ▶ 3 Trials
- ▶ Vary plane, speed and posture
- Error > 2 3/4 inches (4.5°) from center of target

Return to Play

- Symptom free at rest
- Back to baseline on neurocog testing
- No medications
- Symptom free following exertion
- Medically cleared

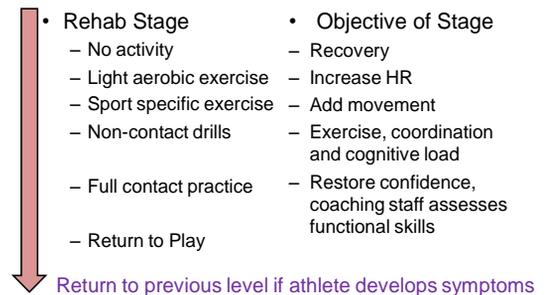


Return to "Play" (RTP) Protocol



Graduated Return to Play Protocol

American Academy of Neurology 2013



- Rehab Stage
 - No activity
 - Light aerobic exercise
 - Sport specific exercise
 - Non-contact drills
 - Full contact practice
 - Return to Play
- Objective of Stage
 - Recovery
 - Increase HR
 - Add movement
 - Exercise, coordination and cognitive load
 - Restore confidence, coaching staff assesses functional skills

Return to previous level if athlete develops symptoms

5 Stages of Exertional Training (UPMC)

1. Light aerobic/conditioning, balance exercises in quiet space with limited head movement
2. Light to moderate aerobic/conditioning, balance exercises with head movement in gym type area; resistance exercise, low intensity sport specific ex.
3. Moderately aggressive aerobic exercises (intervals, stairs etc.), all forms of strengthening, Challenging positional changes, impact activities (running, plyometrics) more aggressive sport specific ex; add concentration challenges
4. Resume aggressive training routines, maximal exertion
5. Full physical training activities with contact

Troutman-Enseki, Emerging Frontiers in Concussion, UPMC, June 2013

Exertional Training

- Sport specific training/exercise
 - Aerobic/conditioning exercises
 - Strengthening/Flexibility exercises
 - Impact exercises (Running, plyo)
 - CORE training
 - Head movement/positional changes
 - Cognitive challenges
- Monitor for:
 - Headache, lightheadedness, nausea, dizziness, mental fatigue, mental fogginess
 - Recovery preferably within 1-2 hours

If symptoms persist return to prior level



Physical Therapy Management Guidelines

- Begin **slowly**
- Monitor symptom response
 - Intensity (VAS)
 - Recovery time
- Progress **slowly**
- Monitor activity

Minimize Symptom Provocation

Summary

- Dizziness/Imbalance associated with PCS is related to altered sensory integration
- Symptom provocation may be indicative of cerebral over-exertion
- Physical therapy intervention must be carefully prescribed to promote recovery while not over-exerting the CNS

