Physical Therapy Intervention Following Concussion

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Objectives

• 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

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 (?)
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:

X2 Viewing Exercises

Progression of Gaze Stability Exercises

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

Complex Background

Vestibular Hypofunction vs Concussion

• Concussion
  – Fewer repetitions
  – Reduced frequency
  – Monitor for onset of headache, fogginess
  – 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 ¾ 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

- 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

Exertional Training

- Sport specific training/exercise
  - Aerobic/conditioning exercises
  - Strengthening/Flexibility exercises
  - Impact exercises (Running, plyometrics)
  - CORE training
  - Head movement/positional change
  - 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

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

Thank You