Evidence Informed Cervical Assessment and Treatment for Concussion

Concussion / Cervical Spine

• In PCS manual treatment for cervical TP, HA Makdissi et al 2013
• Great importance for clinicians to evaluate cervical spine for dysfunction and determine contribution to dizziness Reneker et al 2014
• Evidence based classification system for PCS: vestibulo-ocular, cervicogenic, and physiological Ellis et al 2014

Concussion / Cervical Spine

• Multimodal treatment of cervical spine/PCS: improvement noted for neck pain, dizziness and HA Schneider et al 2015 **RCT N=31
• 5 Case studies indicating cervical spine treatment for chronic symptoms of concussion should be considered and studied further Marshall et al 2015
• In treadmill testing if symptomatic but tolerated complete testing pt then evaluated for additional involvement of cervical, oculomotor or vestibular system Leddy et al 2016
Symptoms / Cervical Spine

• Cervical spine rehab -> HA, neck pain and dizziness (C0-1, 1-2, 2-3)
  
  – Changes in cervical afferent input can cause dizziness, unsteadiness and visual disturbances
    Kristjansson and Treleaven 2009
  
  

Functional Questionnaires

Clinical Application and Example

GOAL: Healthy Spine and Jaw

- Full myotomal and DNF strength
- Proprioceptive control
- Knowledge of spine mechanics
- Full and pain-free motion
- Proper posture alignment
- Neck Disability Index
- Headache Disability Index
- Dizziness Handicap Inventory
- Neck Disability Index
Case Study

• 49 y.o. male concussion / injury 4/16 via compression on top of head while performing in circus
• Initial PT visit: 4/26
• Symptoms: dizziness, intermittent HA, light/sound sensitivity
• Unable to return to job at this time due to symptoms

Findings:
Upper cervical
Soft tissue
Lower cervical
Thoracic
Jaw

Interventions

Manual interventions:
• Massage: cervical and jaw muscles
• Mobilizations to hypomobile joint segments
  • C0-1, C1-2, C2-3
  • C3-4, C4-5, C5-6
  • Thoracic spine
• Jaw
• Stretching

Exercise:
• ROM exercises: repeated motions ie. retraction
  • Neck, jaw and thoracic
• Posture and ergonomic education
• Strengthening
• Proprioceptive work on cervical spine
• Kinesio-taping

Note:

From experience:
It is beneficial to correct neck mechanics and reduce HA symptoms prior to adding vestibular based gaze stability exercises
Take home messages

- A combination of approaches (manual and exercise) is needed to reduce symptoms in patients after concussion related to cervical spine
- In acute cases it is necessary to use caution when evaluating and issuing / progressing exercises
- **Neck pain does not have to be present to be involved in symptoms**

Evidence Informed Vestibular and Balance Assessment and Treatment for Concussion

- **Objective:** To be informed through current medical evidence about concussion rehabilitation combined with clinical skill and expertise in order to design and implement the most effective and precise assessment and treatment of an individual with post concussion syndrome to facilitate their “return to life.”
Clinical Oculomotor and Balance
Concussion Assessment

- Static
- Dynamic
- Integrated
- Functional
- Combined

Clinical Oculomotor and Balance
Concussion Treatment

- Static
- Dynamic
- Integrated
- Functional
- Combined
Clinical Application and Example

• Mechanism of injury, associated injury and symptoms, prognostic modifiers

• Functional questionnaires
  – Graded Symptom Check List
  – Dizziness Handicap Index
  – Headache Disability Inventory
  – Activities Balance Scale

Clinical Application and Example

– Oculomotor assessment
  • Near point of convergence
  • Saccade testing
  • VOR
  • Smooth pursuit
  • SVAT vs DVAT
  • Anti-saccades
  • VOR CX
  • King-Devick Test

– Balance assessment
  • BESS TEST
  • Functional Gait Assessment
  • CTSIB
  • SDT
  • Dual tasking

Clinical Application and Example

– Oculomotor treatment
  • VOR
  • Smooth pursuits
  • Saccades
  • Brock string
  • Three point card

– Balance treatment
  • Static
    – Varied surfaces (Foam)
    – Varied positions (Tandem & single leg)
  • Dynamic
    – Varied positions (Tandem walk, Grape vine)
    – Varied environments
Clinical Application and Example

– Combining Balance and Vestibular treatment
  • Dual tasking
  • Balance with eye movements
  • Balance with eye and head movements
  • Real life task specific training

Case Study

– 14 year old female color guard in the marching band who sustained a concussion hit in the head by her flag
– Initial visit 14 days after injury
– Symptoms: headache, dizziness, fatigue and cognitive difficulties
– Unable to participate with school or color guard

Findings:
Balance
Oculomotor

Outcomes: DHI, HDI, NDI, FGA

References

References


To Rest or Not to Rest?

- Is there more harm from prolonged inactivity? DiFazio et al. 2016
  - Health status and demands of sport
- Factors to consider
  - Social and Ethical
  - Legal
  - Economic
  Liem et al. 2016
The Exertion Test
Buffalo Concussion Treadmill Test

- Used for protracted concussion symptoms
  - > 3 weeks
- Protocol progression
  - 3.6 MPH 0% incline
  - Increase incline by 1% for 1-minute intervals
    - Until max obtained, or patient can not continue
  - Increase speed by 0.4 MPH for each minute
  - Maximum of 21 minutes
- Every Minute, check:
  - BORG
- Every 2-minutes, check:
  - Heart Rate
  - BP
- Stop if:
  - Increase in symptoms by > 3 points on VAS
  - RPE > 18, or at “Exhaustion”

High Intensity Exercises and Post Concussion Response

- Dynamic postural control
- Neurologic symptoms
  - Neuro cognitive
- Physiologic
- Gender different responses

Reliability of Graded Exercise in Assessing Concussion Recovery

- Looked at retest reliability
- Raters found:
  - Sensitivity of 99% for ID factors with symptom exacerbation
  - Specificity of 89% for ruling out concussion symptoms
- Treadmill test had good reliability of HR (ICC 0.79) but not for BP, or for Perceived Rate of Exertion (Leddy et al. 2011)
Exertion Testing in Youth with Post Concussion Symptoms

- Post concussion patients
  - Mean age 14.8 years
  - Mean symptom duration: 6.3 months
- Looked at exertion testing on cycle ergometer
  - 63% had symptoms during exertion
  - Symptom score affected perception of exertion at 50% peak mechanical power
  - Both the number and severity of symptoms significantly improved over 24 hours
- 56.8 percent
  \cite{DeMatteo2015}

Use of Exertion Testing for Return to Play

- Time to pass BCTT (mean)
  - Boys: 22.0 days
  - Girls: 33.0 days
  - Total: 24.0 days
- All athletes returned to play in the week following completion of the BCCT
- Buffalo Concussion Treadmill Test in combination with the Zurich consensus guidelines seems to be safe
  \cite{Darling2014}
Return to Play / Monitoring Symptoms

- Graded symptom checklist
  - Pre and post-exercise
- Borg Rating
  - Perceived Exertion (RPE)
    - During each phase and cycle
- Heart Rate
  - During each phase and cycle for clinic-based interventions
- Symptoms
  - During each cycle

Return to Play / Function

A Collaborative Approach

- MD – Family and / or Team Physician
- Physical Therapist
- Athletic Trainer
- Neuro-Psychology
- Speech Pathology
- Parent
- Coach – School Administration, if needed
- Athlete
- Athlete

Conclusion

- A graded aerobic exercise program can be appropriate for a patient with protracted concussion symptoms
  - Deconditioned status
  - Patient Specific
- Neurocognitive symptoms and balance problems may increase following exercise
  - May be gender specific
- Long term effect of graded exercise program may facilitate return to play
- Return to Play
  - Specific to the individual
References

• Liem BC et al. Final comment: return-to-play decision making: does level of competition make a difference? Phys Med Rehab. 2016;8:139-143