Concussion and OMT
Sports Medicine: Screening and Treating

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Objectives

• Define and discuss concussion diagnosis and screening.
• Discuss how osteopathic manipulative medicine can be applied to help address concussion injuries.
• Discuss the application of osteopathic manipulation through the autonomic nervous, lymphatic, and musculoskeletal systems.
• Review Fulford’s shock release, dural release, and venous sinus drainage and how it can help concussion symptoms.
Concussion

• Form of mild traumatic brain injury following a biomechanical force
• Results in the rapid onset of short-lived impairment of neurologic function
• LOC not necessary and does not correlate with severity
• Centers for Disease Control and Prevention estimate that as many as 3.8 million sport-related traumatic brain injuries occur annually
Pathophysiology

• Concussion results from a rapid rotational acceleration of the brain which causes a shear strain which then induces immediate changes in brain neurochemistry:
  - Neuronal depolarization
  - Local lactic acid accumulation
  - Decreased cerebral blood flow with mismatch of cerebral glucose supply and demand
Evaluation - History

- Mechanism
- Symptoms
- Prior concussion
- LOC
- Change in mental status
- Seizures
Common Symptoms

**COGNITIVE**
- Feeling Mentally Fogggy
- Difficulty Concentrating
- Difficulty Remembering
- Repeats Questions
- Feeling Mentally Slowed Down
- Forgetful of Recent Information
- Confused About Recent Events
- Answers Questions Slowly

**PHYSICAL**
- Headache
- Nausea/Vomiting
- Balance Problems
- Numbness/Tingling
- Sensitivity to Light/Noise
- Visual Problems
- Dizziness
- Dazed or Stunned

**EMOTIONAL**
- Irritability
- Sadness
- More Emotional
- Nervousness

**SLEEP**
- Drowsiness
- Sleeping Less Than Usual
- Sleeping More Than Usual
- Trouble Falling Asleep

Department of Osteopathic Manipulative Medicine
Evaluation: Sideline Assessment

• Sideline eval:
  – ABC’s, C-spine evaluation
  – Neurologic exam
  – SPORT CONCUSSION ASSESSMENT TOOL (SCAT-5)
  – Balance Errors Scoring System (BESS)
  – King-Devick test

• Suspected concussion = remove from play

• Serial exams on sideline
Standardized assessment tools

- Standardized Assessment of Concussion (SAC)
- Balance Error Scoring System (BESS)
- Computerized neurocognitive testing (ImPACT)

- Sport Concussion Assessment Tool version 5 (SCAT5) and Child-SCAT5
Sport Concussion Assessment Tool

• Symptom checklist
• Mental status exam –
  – GCS, Orientation, Maddocks questions
  – Reverse digit span, MOY reverse order
  – Immediate and 5 min recall
• Physical Exam
  – Neuro
  – C-Spine
  – Balance / postural stability (BESS)
Balance Error Scoring System (BESS)

Eyes Closed

Firm surface: A, double-legged stance; B, single-legged stance; C, tandem stance. Stances

A foam surface: D, double-legged stance; E, single-legged stance; F, tandem stance.

King Devick Test

- Test of rapid saccadic eye movements
- May be used on the sideline to identify concussed athletes
- Slowing >1 s more than baseline correlates with concussion
Diagnostic Test

- Structural neuroimaging - CT scan and MRI not routinely indicated. Perform if concern for a structural intracranial injury exists (eg, subdural or epidural hematoma) or neurologic signs and symptoms are increasing in intensity despite appropriate management, or when symptoms persist beyond the typical time (three to four weeks).

- Functional MRI and other advanced imaging techniques ie functional near-infrared spectroscopy (fNIRS).
Osteopathic Manipulative Medicine (OMM)

• The application of osteopathic philosophy, structural diagnosis and use of hands on manipulation in the diagnosis and management of the patient.
Four Tenets of Osteopathic Medicine

- Body Unit
- Structure and Function Reciprocally Interrelated
- Rational Therapy
- Self-Regulatory Mechanism
Somatic Dysfunctions

• Definition - Impaired or altered function of related components of the somatic (body framework) system; skeletal, arthrodial and myofascial structures; and related vascular, lymphatic and neural elements.

• Diagnosis
  T - tissue texture abnormalities
  A - asymmetry
  R - range of motion abnormalities
  T - tenderness
Osteopathic Manipulative Medicine –
Goals of Treatment

1. Relief of pain and reduction of other symptoms
2. Improvement of function
3. Increased functional movement
4. Improved blood supply and nutrition to the affected areas.
5. Sufficient return flow of fluids via the lymphatic and venous systems
6. Removal of impediments to normal nerve transmission
Approach to treatment

• An osteopathic approach takes into consideration how the physician can manually diagnose and treat somatic dysfunctions that is contributing to the patient’s pain and preventing optimal health and healing.

• Utilize different models of osteopathic care in our approach patients with a focus on the biomechanical, circulatory and lymphatic, and neurologic models.
Models of Manipulation

- Biomechanical Model
- Neurologic Model
- Respiratory/Circulatory Model
- Psycho-behavioral Model
- Bioenergy Model
Palpation and Sensing

- Group of 4 exercise
- 1 – Head – sense tent/dural
- 2 – T-L assess trauma point, diaphragm, abdominal drag, rib excursion
- 3 – feet – sense midline, whole, int/ext rot LE
- 4 – lying on table
- Keep in mind the anatomy and physiology you are palpating
- Think of the models of treatment affecting the physiology
Palpation & Sensing

• Center yourself
• Check in with own breathing and diaphragm
• Making sure you are physically and mentally grounded
• Meeting the patient
• Mindful & present
• Start with interact with health, ask the question
1. The patient lies supine, and the physician is seated at the head of the table.
2. The physician establishes a fulcrum by resting both forearms on the table.
3. The physician's hands cradle the patient's head, making full palmar contact on both sides.
4. The physician palpates the CRI:
   - Extension/internal rotation: coronal diameter narrows, anteroposterior diameter increases, and height increases.
   - Flexion/external rotation: coronal diameter widens, anteroposterior diameter decreases, and height decreases.
5. The physician notes the amplitude, rate, and regularity of the CRI.
6. The physician notes which bones, if any, have an altered amplitude, rate, and regularity.
Vault Hold

A. The physician's index fingers rest on the greater wings of the patient's sphenoid
B. The physician's middle fingers rest on the zygomatic processes of the patient's temporal bones
C. The physician's ring fingers rest on the mastoid processes of the patient's temporal bones
D. The physician's little fingers rest on the squamous portion of the patient's occiput
E. The physician's thumbs touch or cross each other without touching the patient's cranium
Brain in Motion

The human body is composed of complex interflowing streams of moving energy. When these energy streams become blocked or constricted we lose the physical, emotional and mental fluidity potentially available to us. If the blockage lasts long enough or is great enough, the result is pain, discomfort, illness and distress.

Robert C. Fulford, D.O.
Trauma

• Connective tissue energy flow disrupted
• Distortion caused an “Energy Sink”
• Assess for trauma points along the costal margin
Fulford’s Shock Release

• Technique to help restore midline and to release “shock” from the diaphragm
• Fingers line up below xiphoid process
• Slowly advance fingers with exhalation
• Hold till release
• Reassess region and globally
OMT - Respiratory Circulatory model

• Goal is to improve respiratory and circulatory/lymphatic flow.
  1. improve motion of the thoracic cage
  2. addressing any diaphragm restrictions
  3. promote fluid movement through pumps

• Increased respiration and circulation --> increase oxygenation --> healthier tissues

• Treatments used in the Resp/Circ model include: Lymphatic pumps, diaphragm doming, thoracic inlet myofascial, balanced ligmentous tension
Thoracic Pressure Changes Help Thoracic Lymph Flow

- Shape changes in the thorax augment both venous and lymphatic return
- How to augment the shape change:
  - Treatment of the Diaphragm
  - Oscillation & resonant fluid waves through the thorax
OMT to help remove restrictions to Lymph Flow

- Doming the diaphragm and thoracic inlet myofascial release techniques are used to improve diaphragmatic movement and lymphatic drainage.
Recently published in 2015, the glymphatic system has been discovered in the brain’s dural sinuses and around the meningeal arteries. The lymphatic like vessels drain inflammatory markers into cervical lymph nodes.
Circulatory/Lymphatic

- CSF-mediated removal of tau via glymphatic routes is crucial for limiting secondary neuronal damage following traumatic brain injury.
- MRI studies have demonstrated that head trauma, such as subarachnoid hemorrhage, severely impairs glymphatic function.
- OMT can be directed to remove MSK and dural restrictions and to improve venous sinus drainage and glymphatic flow.
Sleep and glymphatic flow

• Scientists watched dye flow through the glymphatic system, a brain "plumbing" system, of a mouse when it was asleep (left) and then, later, when it was awake (right).
• More dye flowed into the brain during sleep.
• Results from this study suggest the brain may flush out toxic molecules associated with neurodegenerative disorders during sleep.

https://www.youtube.com/watch?v=awAK_AkouYM
OMT to help promote lymph flow of the glymphatic system

- Diagnose and treat potential SD of the thoracic inlet, head and spine.
- Address dural strain OA, C2-3, Sacrum
- Treat OA junction, Base spread
- OM suture
- Venous sinus drainage technique
- Diagnose and treat cranial strain patterns
Cervicogenic PCD

- Cervicogenic PCD is characterized by muscle trauma and inflammation secondary to cervical spine somatosensory system
- Cervical proprioceptors
- Compression of cranial and cervical nerves
- Autonomic imbalance
A myodural bridge (MDB) extending from the anterior fascia of the *rectus capitis posterior major* (RCPma) and *obliquus capitis inferior* (OCI) muscles, attaching on the cervical dura mater. The myodural bridge (MDB) communicates with the posterior aspect of the cervical dura mater between the C1 and C2 vertebrae.
Vestibulo-ocular PCD

- Vestibulo-ocular PCD is characterized by symptoms secondary to dysfunction of the vestibular and oculomotor systems.
- The vestibulo-ocular reflex (VOR) in particular is a mechanism for producing eye movements that counter head movements, thus permitting the gaze to remain fixed on a particular point.
The cervico-ocular reflex (COR) is a spontaneous eye response that is elicited during neck rotation. Research supports the theory that the purpose of this reflex, along with the vestibulo-ocular reflex and the optokinetic reflex, is to stabilize visual image during body movement. An article written by Kelders suggests that the stimulus is recognized via the proprioceptors of the cervical muscles and facet joints (Kelders et al, 2003). This reflex occurs in both active and passive rotation of the neck when these receptors are excited. Studies published that indicate that the COR is enhanced in people with neck pain. De Vries and colleagues suggest that the reason for this is due to the increased and modified afferent signals received by cervical muscles.
Fulford Dural Release

- EOM attach to the sphenoid along the annulus of Zinn
Fulford Dural Release

- Assess for craniocervical dysfunctions
- Instruct patient to look to the right and then proceed to passively turn the neck slowly in the same direction.
- Upon reaching the end range of motion have patient look to the left and then passively turn the neck to the left.
- Repeat till motion is smooth (2-3 times)
- Instruct patient to look to the right and then proceed to passively turn the neck slowly in the opposite direction, to the left.
- Upon reaching the end range of motion have patient look to the left and then passively turn the neck to the right.
- Repeat till motion is smooth (5-6 times)
- Reassess
The objective is to increase intracranial venous drainage by affecting the dural membranes that comprise the sinuses. Thoracic outlet, cervical, and occipitoatlantal joint somatic dysfunctions should be treated first to allow drainage from the venous sinuses.

1. The patient lies supine, and the physician is seated at the head of the table with both elbows resting on the table, establishing a fulcrum.
2. For occipital sinus drainage, the physician cradles the back of the patient's head and places the second to fourth fingers of both hands in opposition along the midline from the inion to the suboccipital tissues.
3. This position is maintained with minimal pressure (the weight of the patient's head should suffice) until a release is felt (apparent softening under the fingers).
4. The physician maintains this pressure until both sides release, as well as the area of the confluence of sinuses (at inion).
5. For transverse sinus drainage, including the confluence of sinuses, the physician places the finger pads of both hands across the superior nuchal line.
6. For drainage of the straight sinus, the physician places the fifth fingers at inion, or the physician can place the fifth fingers or the thumbs at inion, and the fingers on the other side of the hand are directed anteriorly along the midline of the cranium, such that there is a goal to have a connection to the straight sinus’s directionality between these fingers. The physician’s elbows are supported on the table throughout.

7. For drainage of the superior sagittal sinus, the physician places two crossed thumbs starting at inion and exerts opposing forces with each thumb, moving from inion to lambda, with an intention to release the superior sagittal sinus.

8. Once local release is felt, the physician moves anteriorly and superiorly along the superior sagittal suture with the crossed thumb forces, noting releases at each location toward bregma.

9. Once at bregma, the physician places the second to fourth fingers of both hands in opposition along the midline on the frontal bone at the location of the metopic suture.

10. The physician continues anteriorly on the frontal bone, disengaging the suture by gently separating each finger on opposing hands.

11. The rate and amplitude of the CRI, especially fluid fluctuations, are retested to assess the effectiveness of the technique.
Venous Sinus Drainage

Occipital Sinus

Transverse sinus
OMM research approach to treat concussion

- Cranial – OA decompression, V-Spread, Venous sinus drainage, BMT for strain patterns, any cranial lifts (as deemed appropriate), and treatment of any other somatic dysfunctions. Cranial treatments should end with CV4
- Spine – Use of appropriate techniques for the dysfunctions, such as Balanced ligamentous tension, muscle energy techniques, facilitated positional release, articulatory techniques (ART), high-velocity low-amplitude, and counterstrain
- Rib Cage – Thoracic outlet release (TOR) should be performed first. Any additional rib cage dysfunctions can be addressed with rib raising, ART, or any other standard OMT.
- Sacrum//Pelvis – Address dysfunction with appropriate standard OMT.
EBM OMT application to concussion


• Retrospective chart review. 26 subjects.

• Paired sample t-tests revealed that OMT improved each of the 22 self-reported symptoms listed on the SCAT2.

• 10 symptoms - headache, pressure in head, blurred vision, sensitivity to light, feeling in a fog, don’t feel right, difficulty concentrating, fatigue or low energy, irritability, and sadness (45.4%) demonstrating statistically significant improvement (p<.05).
OMT EBM for treating concussion symptoms - Dizziness

  Patients aged 65 or older found that an OMM protocol focused on cranial manipulation and vestibular balance control structures decreased the amount of anterior-posterior sway (p=.001).

  Subjects aged 13-75 who had dizziness for at least 3 months were treated with common OMT techniques. These included muscle energy, HVLA, counterstrain, myofascial release, balanced ligamentous tension, and cranial. The amount of postural sway in the subjects decreased immediately post treatment, and it was maintained at 1 week post treatment (p<.001).
Research being conducted by the OMM department at NYIT

- SOT balance scores acutely improving post-OMT treatment
Summary

- Concussion is a complex syndrome with various presentations.
- Osteopathic manipulative medicine can be integrated to help treat concussion symptoms.
- OMT can address biomechanical restrictions to allow for improved motion and function.
- OMT can potentially assist with lymphatic clearance and circulation to assist with healing concussion injuries.
- Further research needs to be conducted to better understand the mechanisms and efficacy of OMT in sports injuries and athletic performance.
Thank you!