An Osteopaths Approach To The Cervical Spine

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The Updated Four Key Principles of Osteopathic Philosophy: Foundations, 3rd edition

1) The body is a unit, the person is a unit of body, mind, and spirit.

2) The body is capable of self-regulation, self-healing, and health maintenance.

3) Structure and function are reciprocally interrelated.

4) Rational treatment is based upon an understanding of basic principles of body unity, self-regulation, and the inter-relationship of structure and function.

“Osteopathic medicine recognizes that many factors impair this capacity and the natural tendency toward recovery, and that among the most important of these factors are the local disturbances or lesions of the musculoskeletal system.”

- Kirksville College of Osteopathy and Surgery, special committee on
  OPP, 1953
Localization of pain

- Osteopathic principal #1
  - The interconnectedness of structure and function
- “I have neck pain!”
  - Is the origin of the pain truly cervical?
  - Is it during the ROM or end motions?
• **Somatic Dysfunction:**
  ○ Impaired or altered function of somatic framework including muscular, arthrodial, fascial problems and related neurovascular lymphatic elements.

• **Posture:**
  ○ The mechanical deformation from a prolonged ligamentous stretch
  ○ No u/l or segmental pain. No sight or spread pain.
  ○ Does not centralize
  ○ May lead to derangement or dysfunction
  ○ Ex: Pain goes away after static ligamentous stretch
  ○ Correct posture, stretches, PT/OT
Derangement vs. Dysfunction

- **Derangement**: Disturbance of the normal resting place.
  - Segmental and Unilateral distribution of pain
  - Follows dermatome pattern
  - Change in site and spread of pain with provocation
  - Reversing provocation causes pain to centralize.
  - Pain during the motion NOT at END range.
  - Ex: Spinal stenosis → anterior derangement.
  - Ex: Small Bulge → annular tear → disc herniation. Pain w/ extension.

- **Dysfunction**: Mechanical deformation of structurally impaired tissues.
  - Facets, arthritic joints, trigger points, muscle spasm.
  - Restricted ROM
  - Pain at END of motion.
  - Does not radiate
  - Does not centralize
  - No u/l and segmental pain
Functional Anatomy

- Two functionally distinct regions
  - Upper Cervical Spine
    - Occiput-C1 and C1-C2
  - Lower Cervical Spine
    - C3-C7 (the typical vertebrae)
OSSEOUS STRUCTURES

- Seven cervical vertebrae

- Five “typical” vertebrae
  - C3 through C7
  - typical → similar to thoracic and lumbar spine

- Two “atypical” vertebrae
  - C1 (atlas) and C2 (axis)

- Occiput-C1 articulation = functional component of C-spine
Lacks a spinous process and vertebral body

- 1 Cervical Vertebrae (atlas)- Superior View
Axis - Lateral view

- odontoid process, extends to articulate with C1 superiorly
Seventh Cervical Vertebrae

- vertebral prominens → palpation landmark
Occiput - Semispinalis capitis

TENDORPOINTS found on inferior nuchal line at attachment of the Semispinalis capitis
Rectus capitis posterior major/minor
Upper Cervical Spine – *Atypical* Cervical Vertebrae

- Two Vertebrae
  - Atlas
  - Axis
- Three Articulations
- O-A – Occipito-atlantal (Occiput-C1)
- A-A – Atlanto-axial (C1-C2)
- C2 – C3 – typical facet joint
OA- Occiput-C1 ARTICULATION

- Flexion of the skull associated with backward slide of occipital facet (on that of the atlas) – may contribute to nearly 50% of flexion/extension of C-spine
- Head into flexion: occipital condyles glide posteriorly
- Head into extension: occipital condyles glide anteriorly
- Distinct mechanism from the rest of the spine
Occiput-C1 ARTICULATION

Motion in OCCIPUT-C1

- Flexion and extension (primary)
- Side-bending - not significant
- Rotation and side-bending coupled in OPPOSITE directions
- OA Side-bending and Rotation are Opposite Always
AA- C1-C2 articulation

Motions

- Rotation – 50% of cervical rotation
  - Ligaments remain tight (holding dens in place when head is turned)
- Minor flexion/extension
  - Rot and SB in SAME direction
    - occur in rotation only, therefore diagnosis will be either: Rr or Rl
C3 to C7 - Typical Cervical Vertebrae

Motions

- Sidebending + Rotation → Same side.

- C2-C4
  - Primary motion is rotation

- C5-C7
  - Primary motion is sidebending
C3 to C7 - Typical Cervical Vertebrae

- one body
- two pedicles
- two laminae
- one spinous process
- two *articular* pillars (pedicle-lamina junction)
  - area of *facet* formation, clinically useful: aka *palpatory landmark* rather than transverse processes
  - also known as interarticular pillars or as lateral masses
C3-C7- Typical Vertebrae Ligaments

- Anterior longitudinal ligament
- Interspinous ligament
- Posterior longitudinal ligament
- Ligamentum flavum

Ligaments in Spine
Vertebral Artery

- Vertebral artery courses through the foramen transversarium, C 7 does not have the vertebral artery inside a foramen.

**Manual medicine procedures**

- NO side-bending and extension motion
- ROTATION + EXTENSION = accepting
Fig. 12. Anatomy of the cervical spine.
Nerves exiting roots

Due to horizontal anatomy, both discs affect the same nerve root in the cervical spine, different than the lumbar spine.

C8 and above Pedicle / Nerve Root MISMATCH

“Extra C8 Nerve Root (without C8 pedicle) allows transition from MISMATCH to MATCH

T1 and below Pedicle / Nerve Root MATCH

Lumbar Spine Pedicle/nerve Root MATCH
Dermatomes and Myotomes

Dermatomes and Myotomes of Upper Limb

Note: Schematic demarcation of dermatomes according to Rengas and Garretto shows distinct segments. There is actually considerable overlap between adjacent dermatomes. An alternative dermatome map is that provided by Forester.

A. C1 to T3 Sensory Representation

B. Motor Impairment Related to Level of Cervical Root Lesion

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## Dermatomes and Myotomes

<table>
<thead>
<tr>
<th>Nerve Root</th>
<th>Sensory</th>
<th>Motor</th>
<th>Reflex</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1-C2</td>
<td>Front of face</td>
<td>Neck Flexion</td>
<td></td>
</tr>
<tr>
<td>C3</td>
<td>Lateral Head</td>
<td>Lateral flexion</td>
<td></td>
</tr>
<tr>
<td>C4</td>
<td>Supraclavicular</td>
<td>Shoulder shrug</td>
<td></td>
</tr>
<tr>
<td>C5</td>
<td>Lateral shoulder</td>
<td>Shoulder abduction/ Elbow Flex</td>
<td>Biceps (MSK)</td>
</tr>
<tr>
<td>C6</td>
<td>Thumb/index</td>
<td>Elbow flex/ Wrist Ext</td>
<td>Brachioradialis (MSK)</td>
</tr>
<tr>
<td>C7</td>
<td>Middle 3 fingers</td>
<td>Elbow EXT/ Wrist Flex</td>
<td>Triceps (Radial)</td>
</tr>
<tr>
<td>C8</td>
<td>Medial lower arm</td>
<td>Finger Flex/ Thumb ext</td>
<td></td>
</tr>
<tr>
<td>T1</td>
<td>Medial upper arm</td>
<td>Finger ABDuction/ Intrinsics</td>
<td></td>
</tr>
</tbody>
</table>
How's the pain in the neck, today?

Oh pretty good. He just went to work.
Examination: Look: Deformity, wasting swelling
Feel: masses, tendernessness
Move: Pain, stiffness, asymmetry
Neuro: Sensation, reflexes and strength
Special C-Spine Testing

Vertebral Artery Testing
(Wallenberg’s Test)

Nerve Root compression
(Spurling Test)
Range of Motion Testing

Evaluated primarily by passive motion testing—usually patient seated:

- **Flexion**: 0-45°
- **Extension**: 60-80°
- **Side-bending**: 40-50°
- **Rotation**: 70-85°

- Note somatic dysfunctions
- Evaluate all vertebra of C-spine individually at first
- Patient should be supine with examiner at head of table
2 techniques for making diagnosis:

- Lateral translation: sliding or pushing each cervical segment from left to right and right to left
- Palpating the articular pillars of each segment determining which side is more posterior
  - Pushing from left to right = left side-bending
  - Pushing from right to left = right side-bending
- The side that appears more posterior is rotated to that side and thus side-bent to that side
- Compare in flexion and extension
Example of Dx

- **Occiput-C1** - Translate head from left to right and right to left with head in neutral position
  - If motion is greater from left to right then freedom is side-bent left and rotated right, SlRr (restriction in right side-bending)
  - If motion is greater from right to left then diagnosis is **SrRl** (restriction left side-bending)
  - Check with head flexed and then extended
  - If the restriction of lateral translation is more significant in flexion but goes away in extension then the segment is extended
Example of Dx

- **AA** - Patient supine, examiner at head of table
  - Have patient nod head forward (locking OA joint)
  - Physician rotates head left to right
  - If head rotates more freely to the right the diagnosis is **AA Rr**

- **C2-C7** Try to feel which appears more posterior or closer to the table
  - Push the articular pillar gently from left to right and right to left at each segment
  - Identify loss of translation from L to R or R to L
- Check segments that have restrictions in flexion and extension
OMT IS Evidence based

<table>
<thead>
<tr>
<th>Evidence Level*</th>
<th>Recommendation</th>
<th>Studies</th>
</tr>
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<tbody>
<tr>
<td>A</td>
<td>Cervical spine manipulation and mobilization is useful in providing at least short-term benefits for some patients with acute mechanical neck pain and associated headaches.</td>
<td>Hurwitz et al, 1996 [47]</td>
</tr>
<tr>
<td>A</td>
<td>Spinal manipulation should be used to treat patients with subacute or chronic neck pain because it is more effective than muscle relaxants or usual medical care. Effectiveness is enhanced when used in combination with other supportive modalities such as exercise and ergonomic adjustments.</td>
<td>Gross et al, 1996 [48]</td>
</tr>
<tr>
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<td></td>
<td>Fiechtner and Brodeur, 2000 [49]</td>
</tr>
<tr>
<td>A</td>
<td>Spinal manipulation is useful for patients with tension-type headache as it provides short-term relief.</td>
<td>Gross et al, 1996 [48]</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Fiechtner and Brodeur, 2000 [49]</td>
</tr>
<tr>
<td>A</td>
<td>Mobilization or manipulation, or both, plus exercise should be used for patients with subacute or chronic mechanical neck disorders with or without headache to provide both short-term and long-term maintained benefits.</td>
<td>Gross et al, 2004 [51]</td>
</tr>
</tbody>
</table>

*Evidence levels: A, randomized, controlled trials, meta-analyses, and well-designed systematic reviews; B, case-control or cohort studies, retrospective studies, and certain uncontrolled studies; C, consensus statements, expert guidelines, usual practice, and opinion.
Contraindications: (HVLA)

- RA
- Down’s Syndrome
- Elderly (avoid HVLA)
- Ligamentous Instability
- Vertebral insufficiency
Neuropathy vs Radiculopathy

- **Neuropathy involves one nerve branch**
  - Peripherally, tinels often positive, due to entrapment.
  - Weakened muscles and altered sensation in one discrete locale

- **Radiculopathy: Involves one spinal nerve root**
  - Proximally, follows dermatomal distribution, usually involves back pain from osteophyte or disc.
  - Denervation is possible.

- **Double Crush phenomenon:**
  - Rare: Neuropathy and radiculopathy.
Jefferson Fracture

- **C1 Burst Fracture**
  - **MOI:** Axial compression
  - **Radiograph:**
    - Odondoid view: Greater than 7mm b/t lateral masses of atlas on the axis.
    - Unstable fracture
    - Rarely leads to compression due to widening of atlas arch.
Hangman’s Fracture

- Neural arch fracture of axis through the pedicles causing disruption of C2 on C3 stability.
- MOI:
  - Hyperextension injuries
  - Ex: Blows to forehead during football tackling
- Radiograph:
  - Lateral shows disruption through the pedicles of axis.
- Unstable fracture
Dens Fractures

- **Type A:**
  - Through Tip of Dens
- **Type B:**
  - Junction b/t Dens and body of axis
- **Type C:**
  - Through body of axis below dens
- **Type D:**
  - From dens to inferior surface of C2.
Os Odontoideum

- Congenital lack of fusion of dens to axis
- Radiograph:
  - Odontoid view shows disruption in continuity of dens.
  - Discern from fracture by smooth contour and lack of fragments.
Wedge Fracture

- **Mechanism of action:**
  - Hyperflexion
  - Crush injuries like diving

- **Radiograph:**
  - Lateral view
  - Anterior vertebral body edge is >3mm shorter than posterior
  - Stable fracture
  - Leads to kyphosis
Clay Shoveler’s Fracture:

- Avulsion of spinous process
- MOI: Hyperflexion
- Overuse injury leads to detachment
  - Rhomboids, Paraspinals, trapezius muscles.
Hypomobility of C-spine

- Tightness or stiffness of synovial facet joints
- Radiographically: None
- Clinically: dull Pain, stiffness, often leads to headaches

Capsular pattern of cervical spine
- Segmental pain
- Upper cervicals: Limited side bending and rotation in equal amounts and less limitation of extension
- Lower cervicals: Opposite limitations.
Facet Syndrome

- Joint degeneration
- Loading forces lead to cartilage degeneration
- Recurrent joint subluxation or dislocations lead to facet hypertrophy, tropism and encroachment of spinal canal with osteophytes.
- Body reacts with posture and paravertebral muscle spasm to protect the area.
  - Decreased ROM
  - Causality of fatigue.
  - Altered function
Clinical signs of facet syndrome

- Variable presentation
- Paraspinal muscle spasm
- Loss of lordosis
- Loss of ROM in all directions, mostly with extension.
- Pain with extension.
- Normal neurological exam.
Cervical Stenosis

- Narrowing of central spinal canal or intervertebral foramen
  - Congenital, traumatic, age related, degenerative, osteoarthritis
  - Intervertebral disc disease

- Clinically:
  - Radiation in arm
  - Pain with extension
  - Special tests
'Cervicogenic headache' is a term used to define headaches that arise from musculoskeletal dysfunctions in the cervical spine. More specifically, dysfunction is thought to lie within the joints, discs, ligaments, muscles, and/or dura of C0-C3.
CERVICOGENIC HEADACHE
Type of techniques

- Active vs. Passive
- Direct vs Indirect
<table>
<thead>
<tr>
<th>Muscle</th>
<th>Insertion/Attachment</th>
<th>Action</th>
<th>Nerve Supply</th>
</tr>
</thead>
<tbody>
<tr>
<td>Longus cervicis (colli)</td>
<td>Anterior tubercles of vertebrae C3–C6</td>
<td>Spine of axis</td>
<td>Spinal nn. C2 – C7 (anterior)</td>
</tr>
<tr>
<td>Sup. oblique head</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vertical head</td>
<td>Upper thoracic vertebrae</td>
<td>Flexes neck</td>
<td></td>
</tr>
<tr>
<td>Inf. oblique head</td>
<td>Upper thoracic vertebrae</td>
<td>Transverse processes of C4–C5</td>
<td></td>
</tr>
<tr>
<td>Longus capitis</td>
<td>Anterior tubercles of vertebrae C3–C6</td>
<td>Occipital bone</td>
<td>Spinal nn. C3 – C3 (anterior)</td>
</tr>
<tr>
<td>Rectus capitis anterior</td>
<td>Atlas</td>
<td>Flexes head</td>
<td>Spinal nn. C1 – C2 (anterior)</td>
</tr>
<tr>
<td>Rectus capitis lateralis</td>
<td>Atlas</td>
<td>Occipital bone anterior to foramen magnum</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Stabilizes atlantooccipital joint</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Spinal nn. C1 – C2 (anterior)</td>
<td></td>
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</table>
Tender points

**FIG. 28-1** Cervical anterior tender points.
FIG. 28-6 Posterior cervical tender point locations.
COUNTERSTRAIN – PASSIVE INDIRECT TECHNIQUE, ANTERIOR APPROACH

- **C1**- ROT-AWAY, FLEXION/SIDEBENDING MINIMAL
- **C2-C6**- FLEX, SIDEBEND AWAY/ROTATE AWAY
- **C7**- FLEXION, SIDEBEND TOWARD, ROTATE AWAY, MAVERICK POINT
- **C8**- UNDETERMINED MUSCLE. POSSIBLY SCM?

90 SEC HOLD OR UNTIL MUSCLE RELAX
**COUNTERSTRAIN – PASSIVE INDIRECT TECHNIQUE, POSTERIOR APPROACH**

- **C1 INION**: SLIGHTLY LATERAL TO INION/ FLEX
- **C2**: INF. NUCHAL LINE- SEMISPINALIS CAPITIS, EXTENDED
- **C1-OCCIPUT**: INL, BTW. INION AND MASTOID, EXTENDED
- **C2**: SPINOUS PROCESS, EXTENDED, FINE TUNING
- **C3**: INF-LATERAL TO SP- FLEX, SIDEBEND/ROTATE AWAY
- **C4-C7**: EXTEND SB/ROTATE AWAY
Muscle Energy – ACTIVE TECHNIQUE

- Active muscle contraction by patient
- Equal counterforce by operator
- Controlled Joint position
- Controlled contraction intensity
- Used to increase mobility
MUSCLE ENERGY CONTINUE

- Position to the barrier - opposite to Dx
  - EX: FRS-R Extend, SB Left, Rotate Left
- Patient holds the gentle muscle contraction against operator GRADED resistance for 3-5 sec.
- Repeat 3 times with reestablish barrier

ALWAYS RE-ASSESS!!!
Muscle Energy

- Engage the barrier
  - 3 repetitions
  - 3-5 seconds each
  - Establish new barrier
  - Period of relaxation b/t each step
  - Always Reassess!
Muscle Energy – ACTIVE TECHNIQUE

- CERVICAL SEGMENTS- MUSCLE CORRELATIONS

OA:
- Rectus capitus anterior
- Rectus capitus posterior
- superior obliquus capitus
- rectus capitus lateralis
- longus capitus

AA:
- SCM
- Inferior obliquus capitus

C2-C7:
- Rotatores Cervicis Longus and Brevis
- Scalene muscles
- SCM
- Other major flexors and extensors
HVLA

- High Velocity- Low Amplitude

**Side bend style:**
- Side bend opposite of dx.
- Direct force to opp shoulder
- See picture
Rotational Style:
- Quick-Rotation thrust
- Directed force → opposite eye
- Dx: SL + RL
Low Velocity-Low Amplitude

- LVLA used for elderly
- Rehab patients
- Bed bound
- Gentle motions
- No thrust action
- Similar to articulatory technique.
Counterstrain

Note Landmarks: C4

Side bend away - Rotate Away
Sub-Condylar Decompression

Hand Placement:
- Occipital condylar groove

- Uses:
  - CN XII release
  - Suckling in Pediatrics
Sub-occipital Release

Hand Placement:
- Occipital ridge
- Fingers straight

Apply Cephalad traction
Myofascial Release
References:

1- “An Osteopathic Approach to Diagnosis and Treatment”, DiGiovanna, Schiowitz, and Dowling. Pages 125-136, and 143-146


3. Mackenzie
4. Savarese: