Diagnosing Cervical Segmental Vertebral Somatic Dysfunction

ATSU
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Speaker Disclosure Statements

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Objective

- Demonstrate methods to screen for cervical somatic dysfunction.
- Describe the motion patterns permitted at the occipitoatlantal, atlantoaxial, and typical cervical regions.
- Demonstrate diagnosis of the occipitoatlantal, atlantoaxial, and typical cervical regions.

Types of Vertebral Somatic Dysfunction

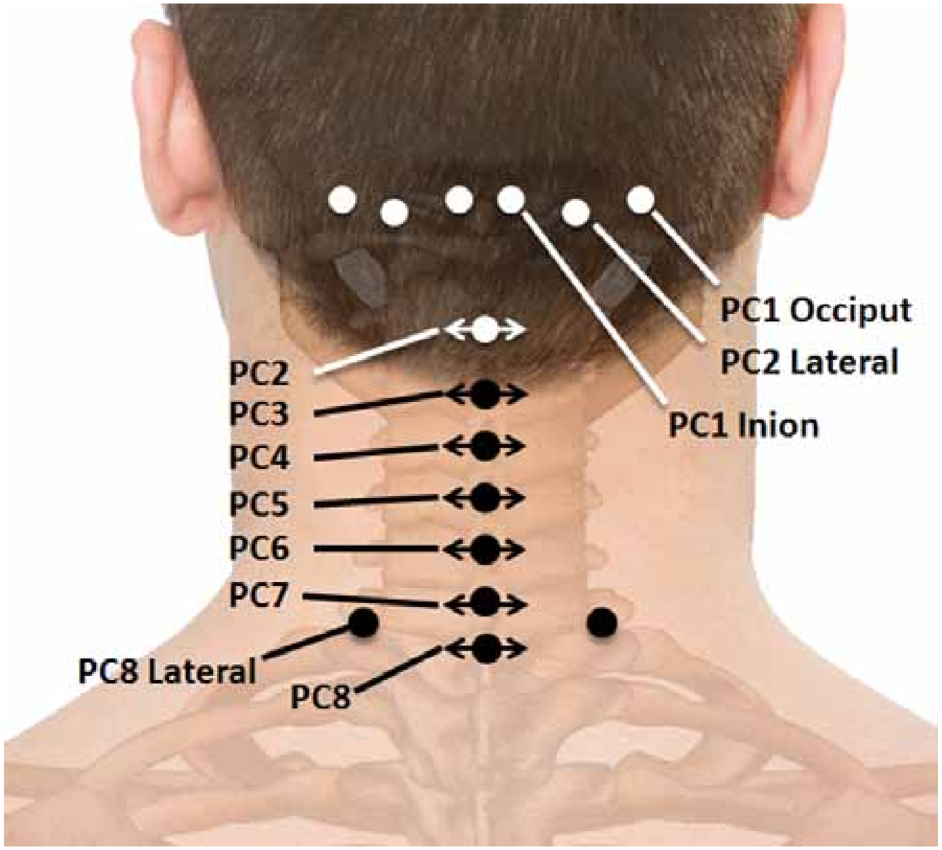
Somatic Dysfunction –

- 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.

Types of Vertebral Somatic Dysfunction

Somatic Dysfunction –

- Tenderness
- Asymmetry
- Restricted range of motion
- Tissue texture abnormalities



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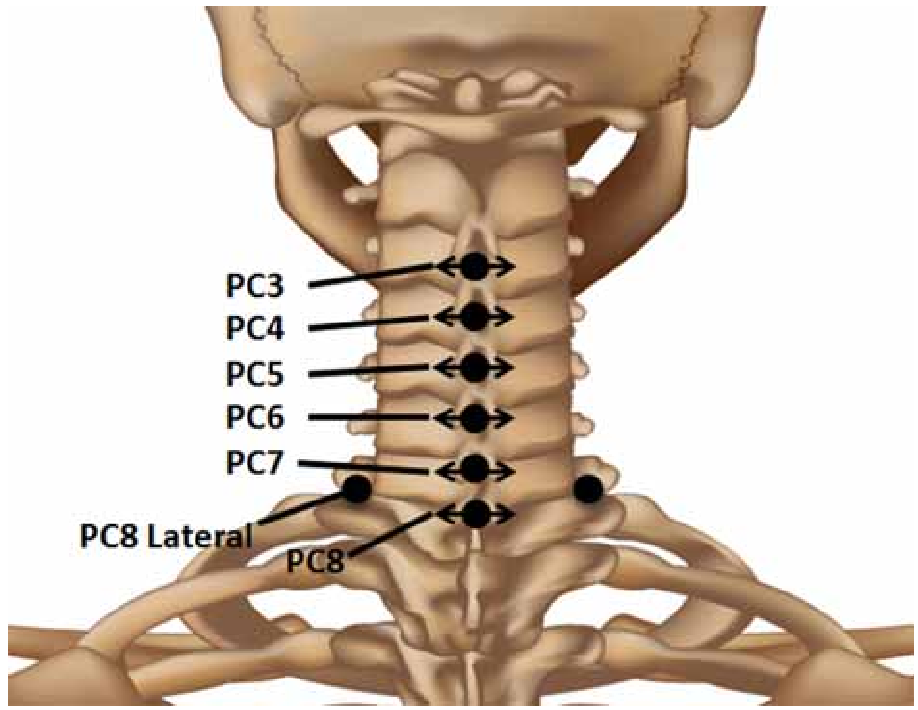
Different types of osteopathic manipulative treatment (OMT) target different types of somatic dysfunction



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Types of Vertebral Somatic Dysfunction

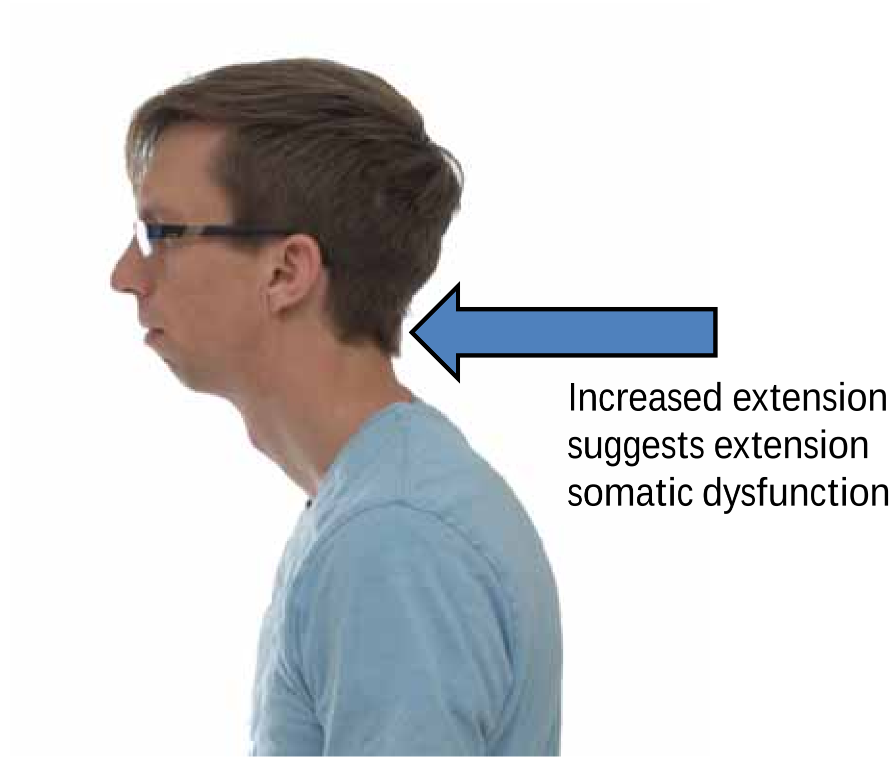
Somatic Dysfunction –

- Tenderness
- **Asymmetry**
- **Restricted range of motion**
- Tissue texture abnormalities

- Primary type of diagnosis used with high velocity/low amplitude and muscle energy OMT techniques

Screening for Cervical Somatic Dysfunction

- Cervical asymmetry (Inspection)
  - Postural imbalance
- Reduced gross cervical range of motion
- Cervical tissue texture abnormalities and tenderness
- Reduced segmental motion



Anterior Head Posture

Cervical Vertebra

Regional Gross Range of Motion

- Flexion – 45°
- Extension – 45°
- Rotation – 80°
- Sidebending – 45°
  - Also known as lateral flexion

Flexion

Extension

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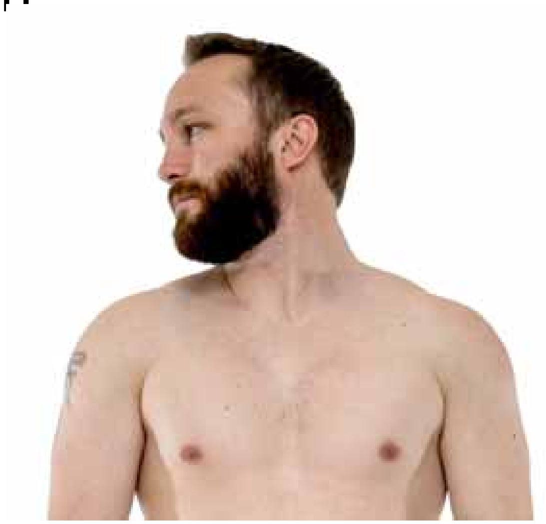

Rotation Right

Rotation Left

Cervical Vertebra

Regional Gross Range of Motion

- Flexion – 45°
- Extension – 45°
- Rotation – 80°
- Sidebending – 45°
  - Also known as lateral flexion

Sidebending Right

Sidebending Left

Cervical Gross Range of Motion

- Assess gross range of motion
  - Sidebending (lateral flexion)
  - Rotation
  - Flexion
  - Extension

Sidebending left

Sidebending right

Flexion

Extension

Rotation left

Rotation Right

Lab Exercise - Cervical Gross Range of Motion

- Assess gross range of motion
  - Sidebending (lateral flexion)
  - Rotation
  - Flexion
  - Extension

Sidebending left

Sidebending right

Flexion

Extension

Rotation left

Rotation Right

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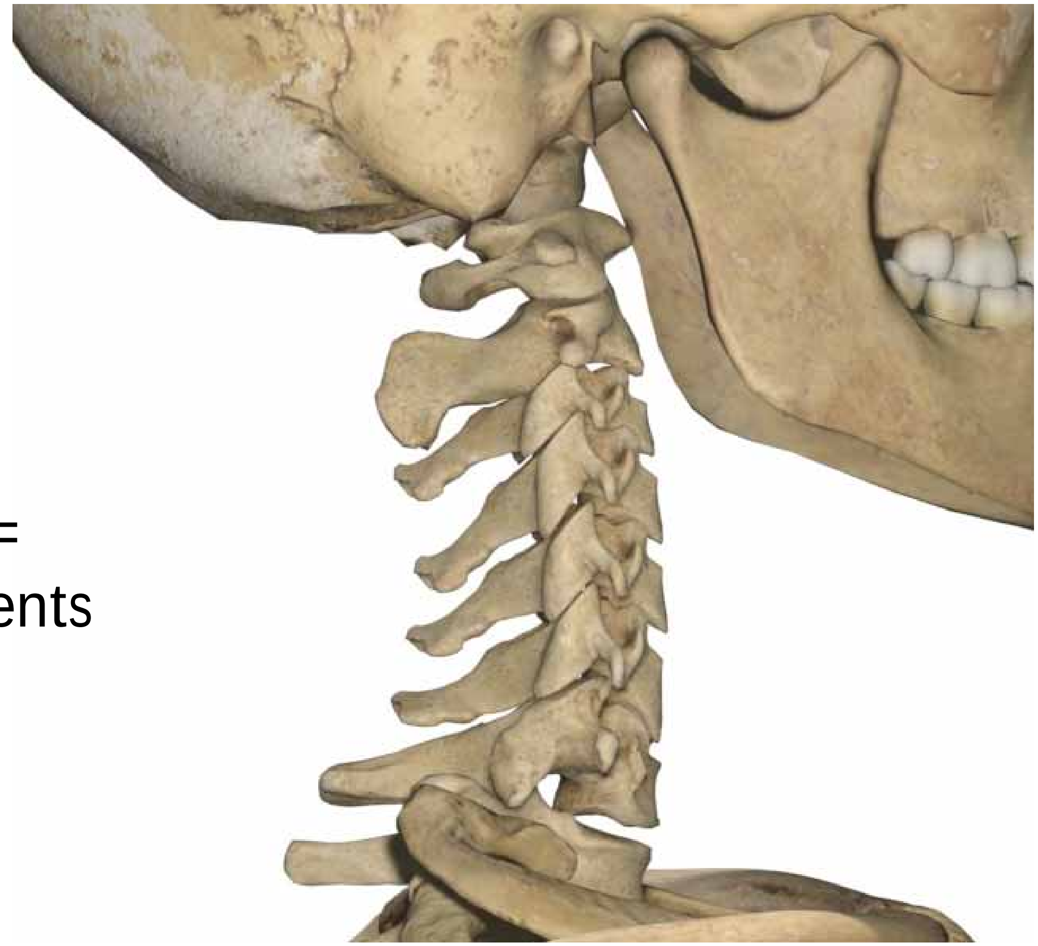
Types of Cervical Vertebra Joint Motion

- Typical Cervical Motion C2-7
- C1-C2, Atlantoaxial (AA)
- C0-C1, Occipitoatlantal (AO)



- Intersegmental range of motion = motion between vertebral segments
- Intersegmental motion varies by measurement method

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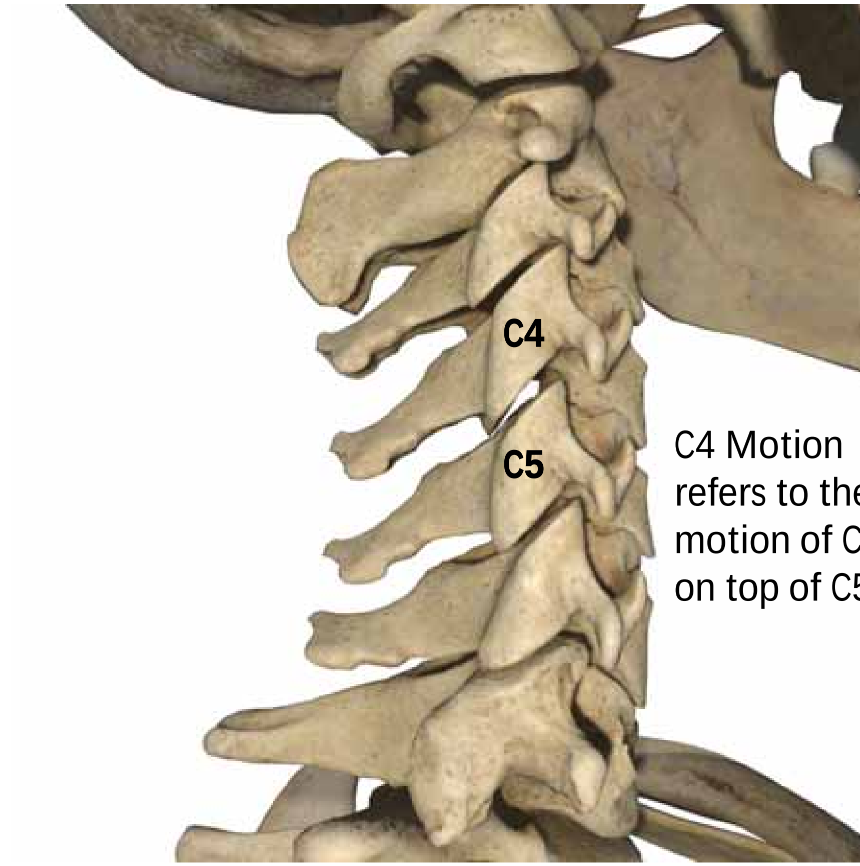
Typical Cervical (C2-7) Mechanics

Typical Cervical Mechanics

- C2-7 Typical cervical joint motion
- Refers to motion of vertebra above on vertebra below
  - Example C4 movement on C5
- Type II Non-neutral -type mechanics
- Flexion and Extension
- Sidebending and rotation occur to the same side with some flexion or extension



C4 Motion refers to the motion of C4 on top of C5

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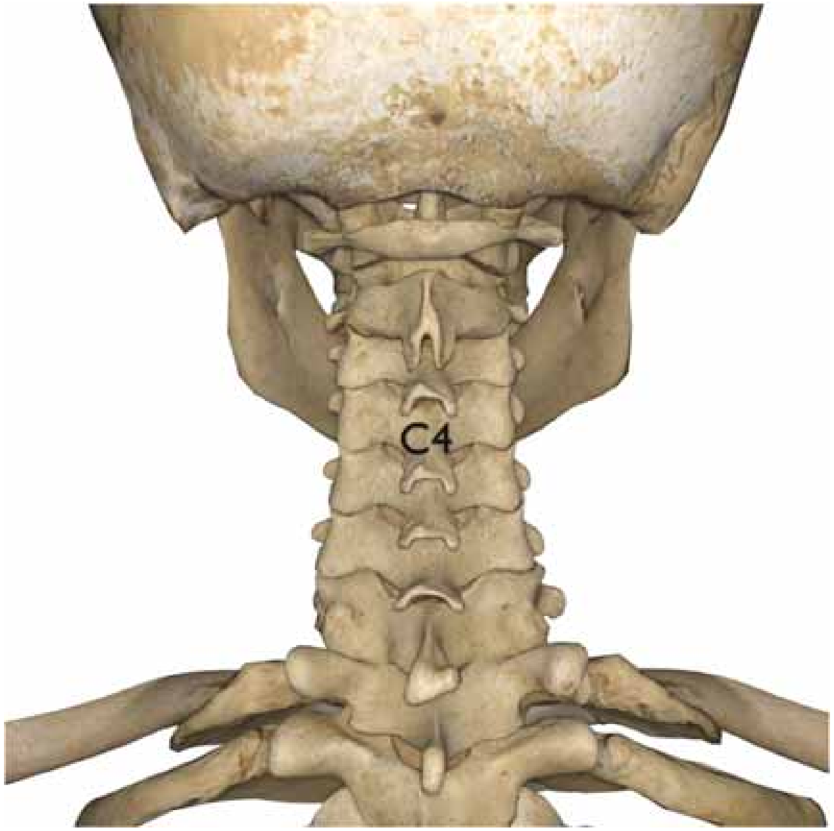

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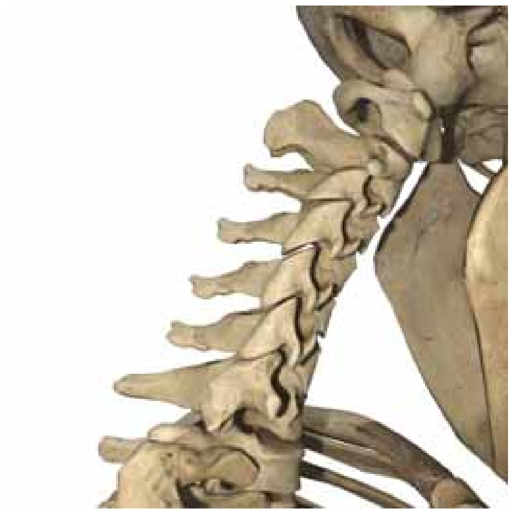


Cervical Flexion

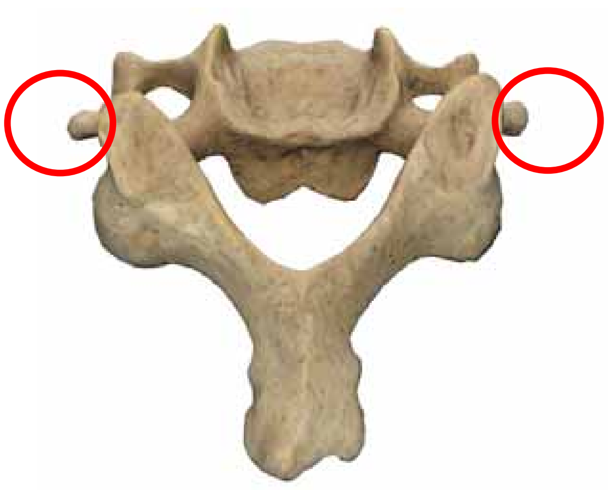
Cervical Extension

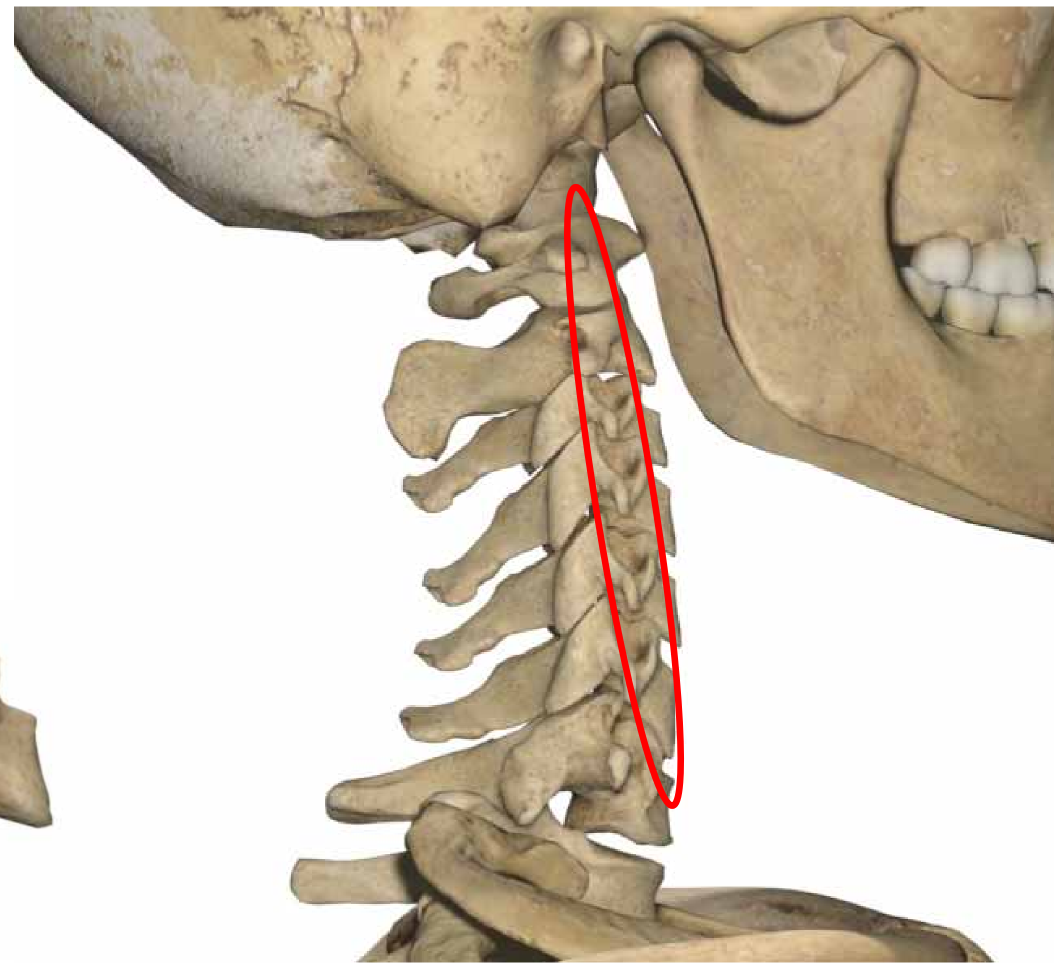
Typical Cervical Mechanics

- C2-7 Typical cervical joint motion
- Refers to motion of vertebra above on vertebra below
  - Example C2 movement on C3
- Type II Non-neutral -type mechanics
- Flexion and Extension
- Sidebending and rotation occur to the same side and must be accompanied by some flexion or extension

Typical Cervical Mechanics

- Saddle shaped vertebral bodies





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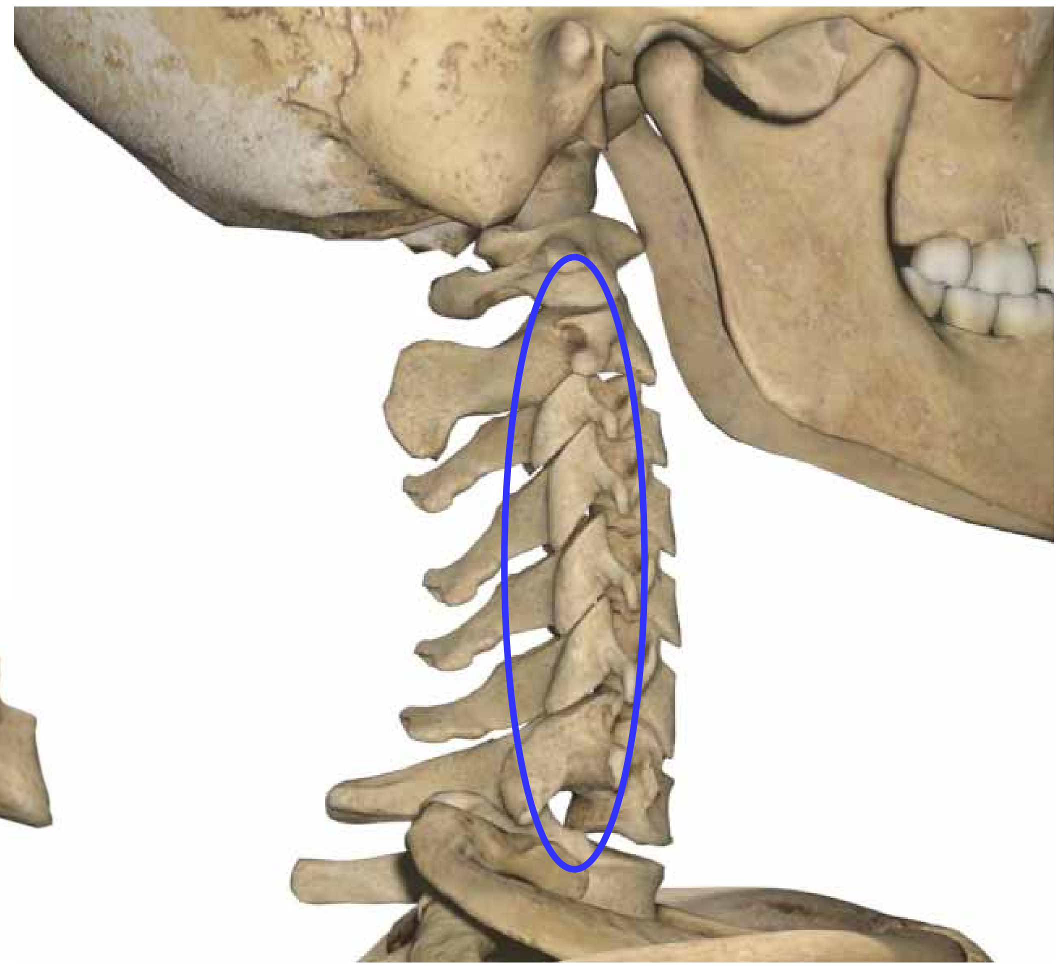
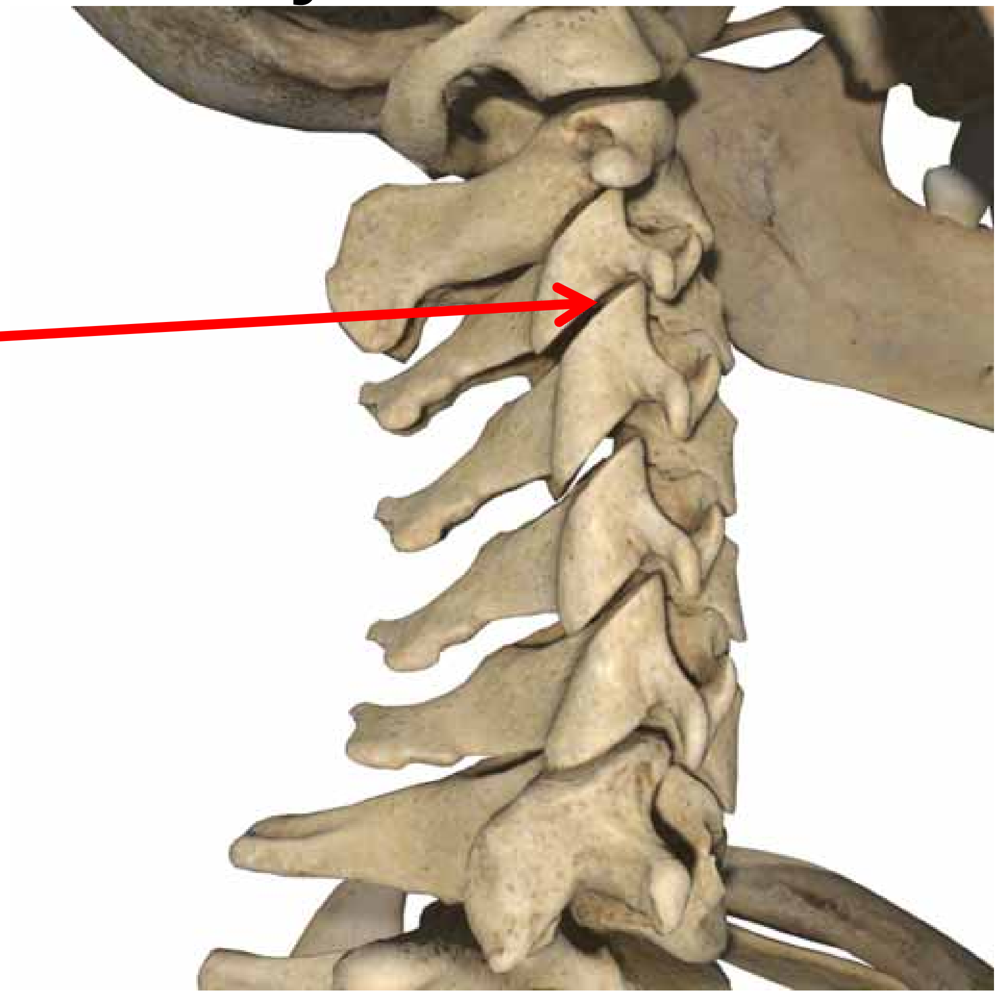


Cervical Anatomy

- Typical Cervical Vertebra
  - Four joints
- Zygapophyseal joints
  - 2 Facet joints
- Uncinate joints
  - 2 Uncovertebral joints of Luschka
  - Lateral aspect of vertebral bodies (uncinate processes)
  - Saddle shaped vertebral body
- Sidebending and rotation to occur to the same side with flexion or extension



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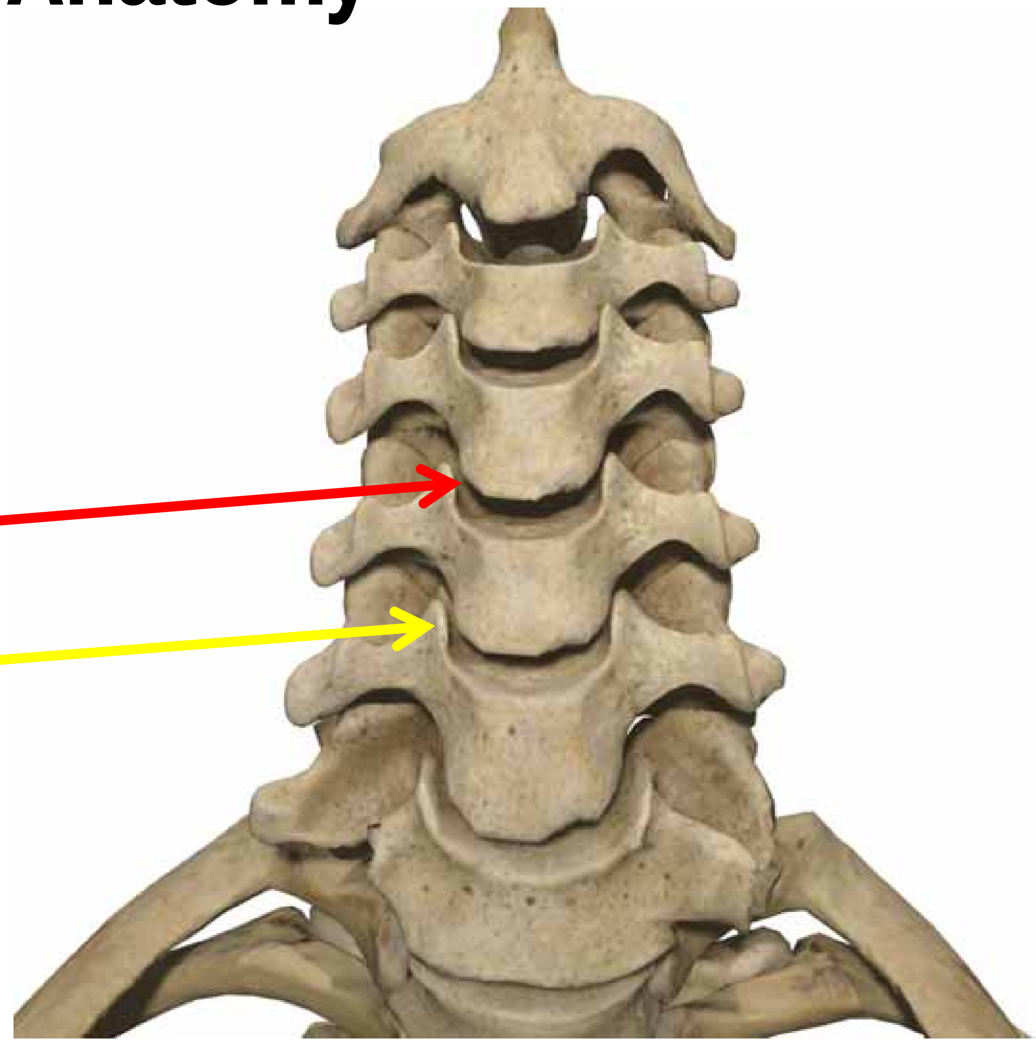

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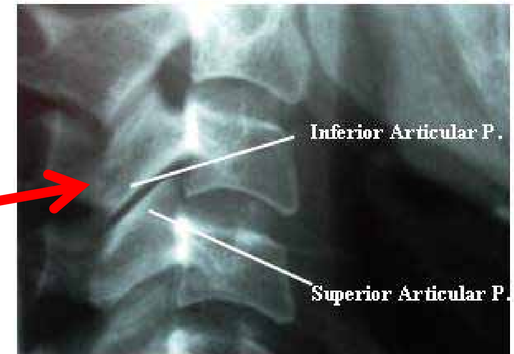
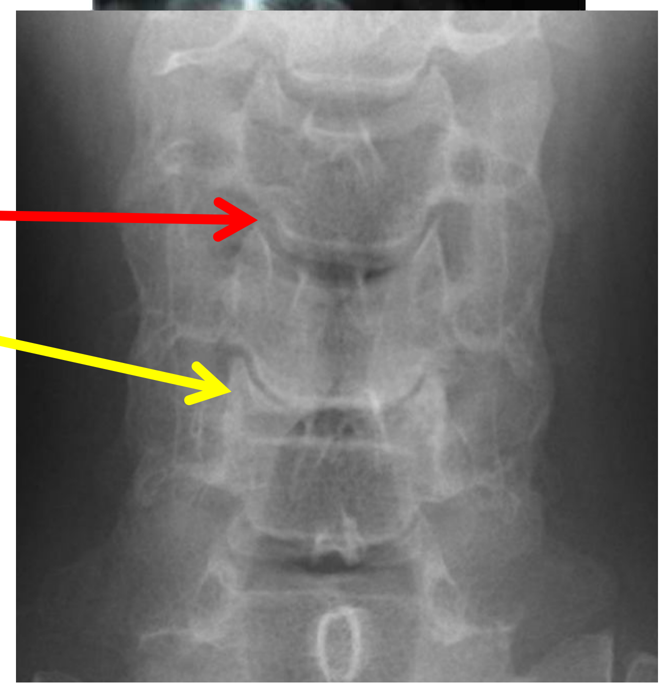
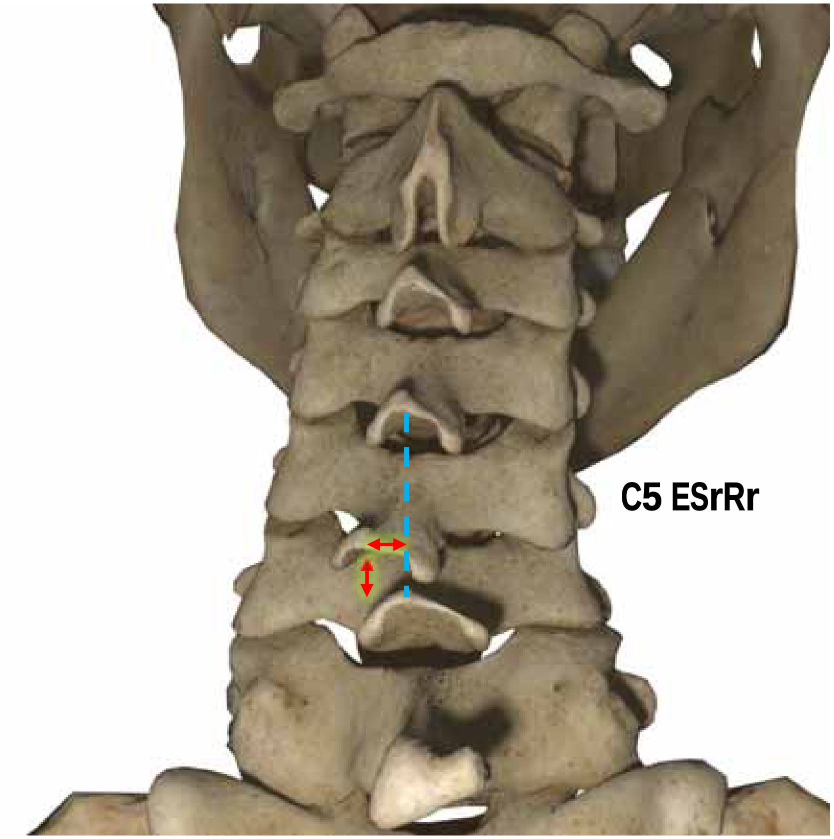




Cervical Segmental Somatic Dysfunction

- Somatic Dysfunction
  - Flexed
  - Extended
  - Flexed, sidebent right, and rotated right (FSrRr)
  - Flexed, sidebent left, and rotated left (FSlRl)
  - Extended, sidebent right, and rotated right (ESrRr)
  - Extended, sidebent left, and rotated left (ESlRl)



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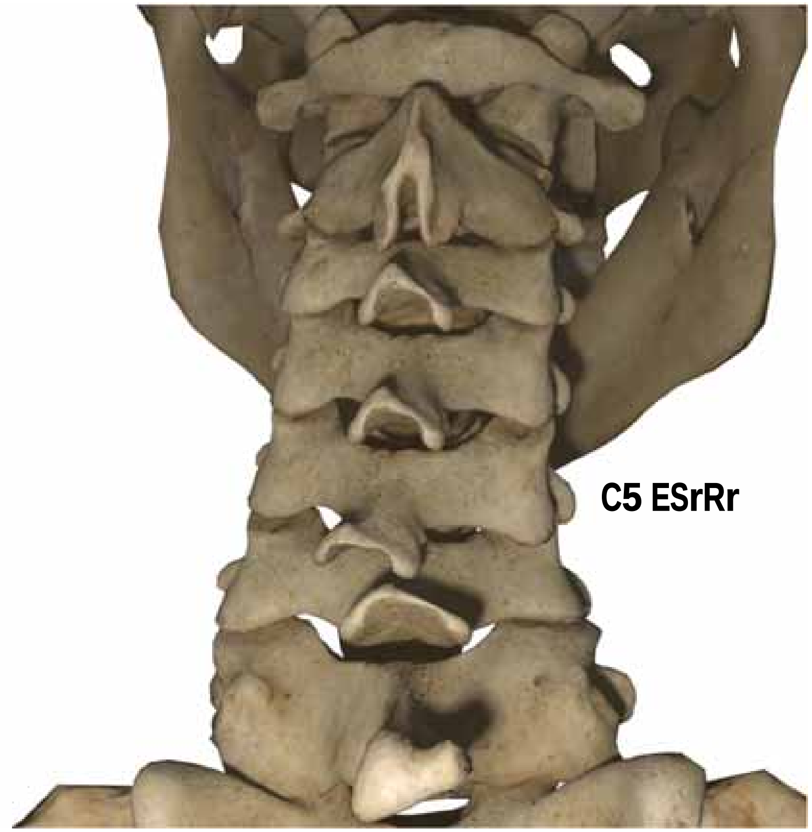


Typical Cervical Diagnosis

- Multiple methods of diagnosis

- Flexion/extension
- Sidebending/translation
- Rotation

- Each motion can be assessed separately or in combination

Cervical Localization

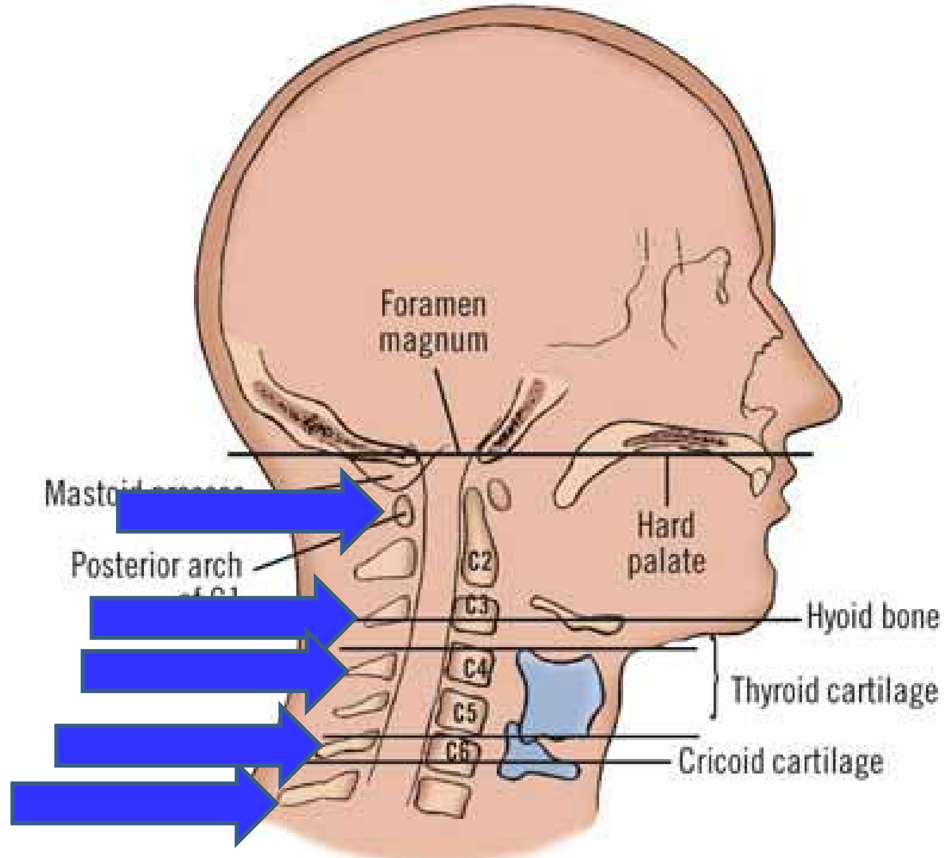
C1 - first spinous process

C3 – level of hyoid

C4 – top of thyroid cartilage

C6 – cricoid cartilage

C7 – vertebral prominens

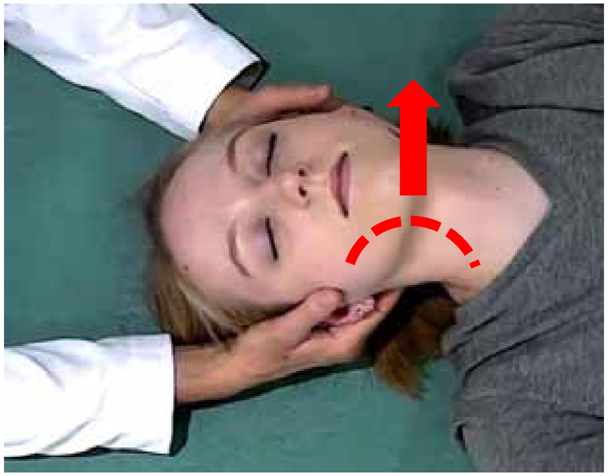


Cervical Translation

Screening for

- Occipitoatlantal Joint
- Typical Cervical Spine
  - C2-C7

- Translation is equivalent to sidebending to the opposite side
  - Right translation is equal to left sidebending
  - Left translation is equal to right sidebending

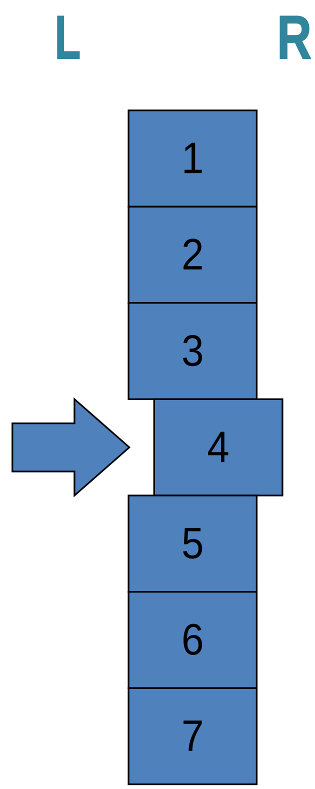


Translation to left induces sidebending to the right

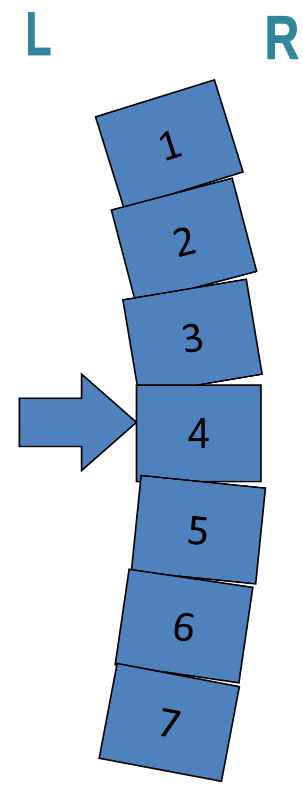
Translation to right induced sidebending to the left

Cervical Translation

Right translation is pushing from the left to the right

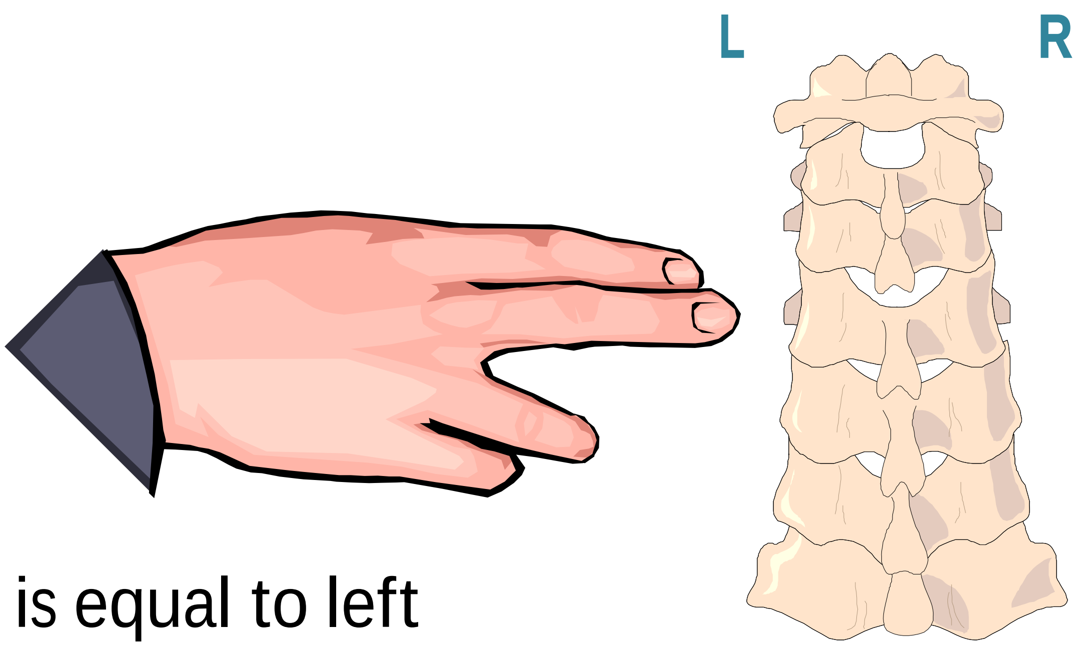


Right translation causes left sidebending



Posterior View

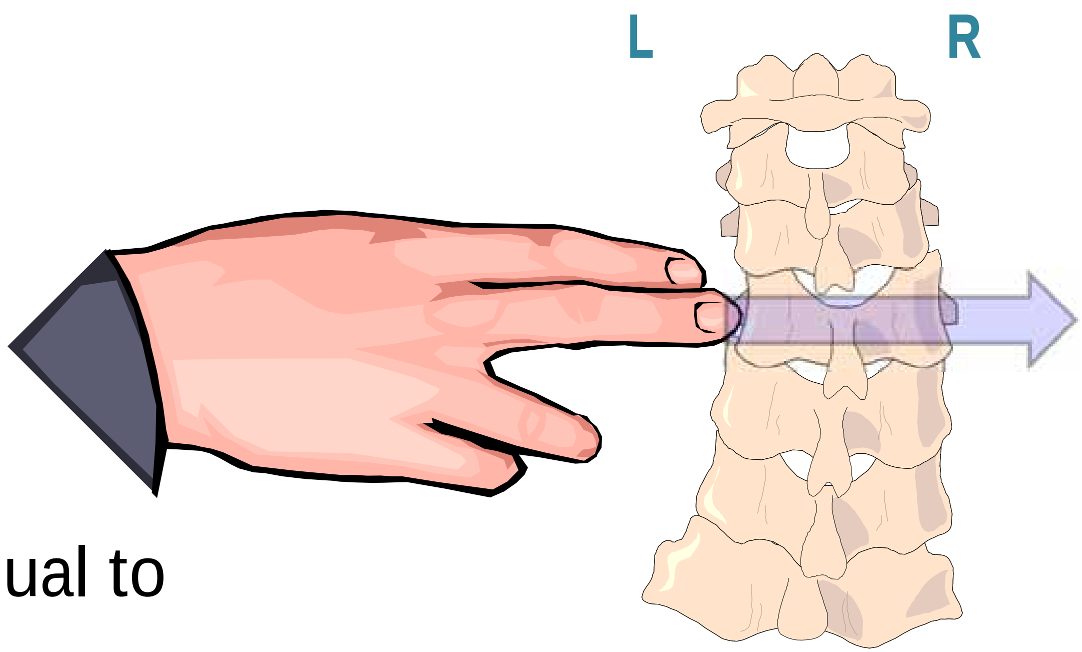
Cervical Translation



Posterior View

- Right translation is equal to left sidebending
- Left translation is equal to right sidebending

Cervical Translation

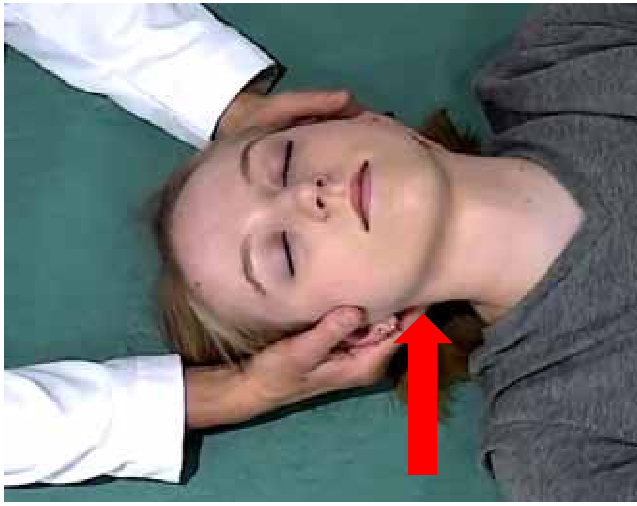


- Right translation is equal to left sidebending
- Left sidebending is coupled with left rotation C2-C7

Posterior View

Cervical Translation Screen

- Identify the articular column of C2-7
  - Identify spinous processes
  - Slide fingers laterally and slightly anterior to identify the firm articular column
- Apply alternating lateral translation on the articular pillars of an individual vertebral segment
  - Place fingers on the articular pillar on each side of vertebra
  - Push to the left on the right articular column (left translation) to assess right sidebending
  - Push to the right on the left articular column (right translation) to assess left sidebending
- Identify restricted motion
  - Name for motion preference
- Screen each vertebra for motion restriction



Translation to left in neutral

Translation to right in neutral

Lab Exercise: Cervical Translation Screen

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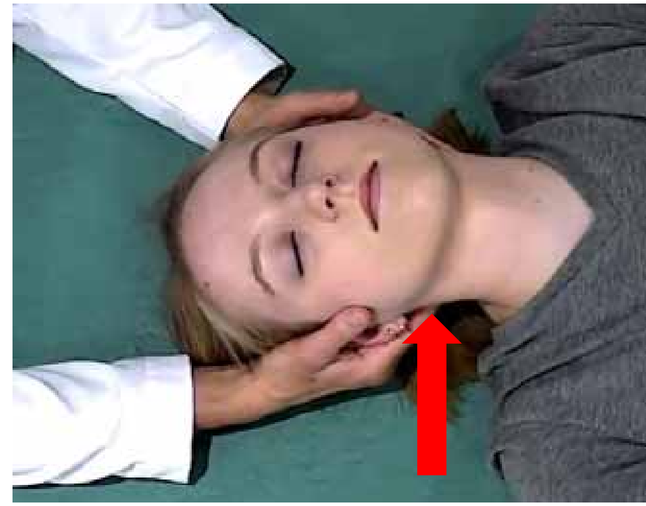

Translation to left in neutral

Translation to right in neutral

Cervical Segmental Diagnosis

Translation screen identifies:

- Reduced left translation = reduced right sidebending
- Reduced right sidebending = Preference for left sidebending
- Left sidebending is coupled with left rotation
- Dx = Sidebent left and rotated left
  - Dx= SlRl

Then, assess translation motion in flexion and extension:

- If motion improves in flexion, then segment prefers flexion
  - Dx = Flexed, sidebent left, rotated left
    - Dx = FSlRl
- If motion improves in extension, then segment prefers extension
  - Dx = Extended, sidebent left, rotated left
    - Dx = ESlRl

Cervical Translation Method

- Apply alternating lateral translation on the articular pillars of individual segments to identify restricted motion
- Assess translation motion in neutral, flexed, and extended positions
- Named for motion preference
- C2-7 assume sidebending = rotation

Translation to left in neutral

Translation to right in neutral

Translation to left in flexion

Translation to right in flexion

Translation to left in extension

Translation to right in extension

Lab Exercise - Cervical Translation Method

- Apply alternating lateral translation on the articular pillars of individual segments to identify restricted motion
- Assess translation motion in neutral, flexed, and extended positions
- Named for motion preference
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Translation to left in neutral

Translation to right in neutral

Translation to left in flexion

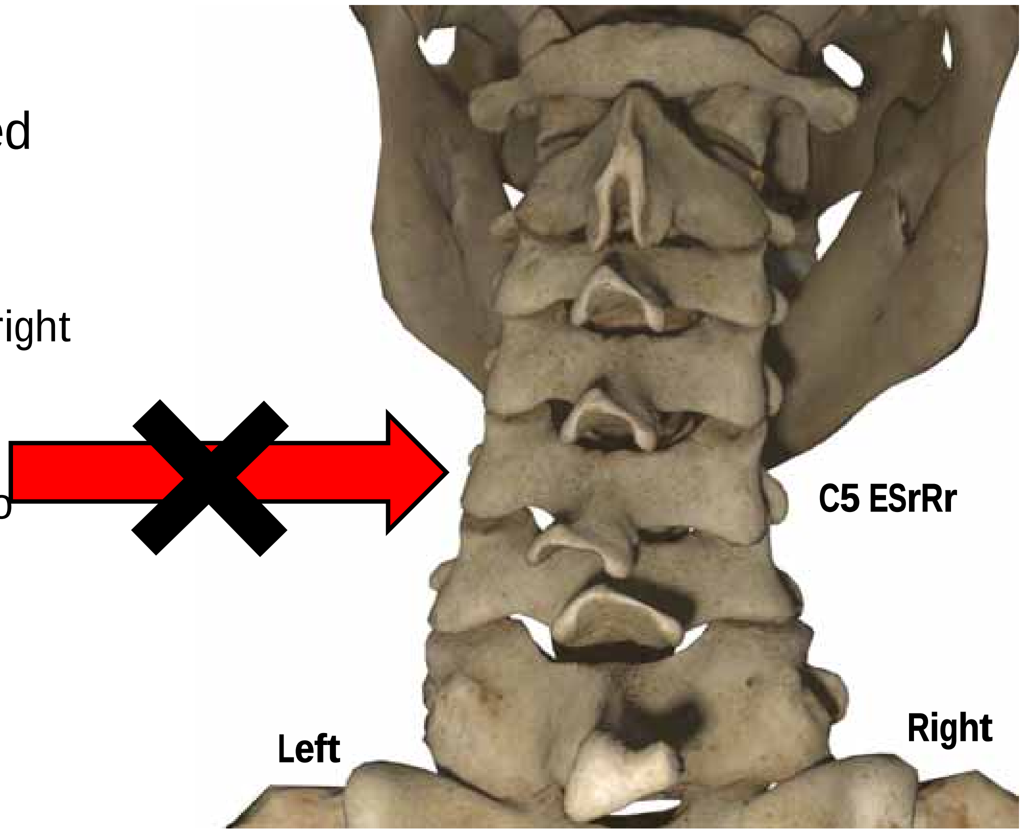
Translation to right in flexion

Translation to left in extension

Translation to right in extension

Cervical Segmental Somatic Dysfunction

- Example
  - Extended, sidebent right, and rotated right (ESrRr)
    - Normal right sidebending motion
    - Resists translation from the left to the right
      - Resists right translation
      - Resists left sidebending
    - Rotation motion preference assumed to same side as sidebending preference
    - Motion worsens in flexion
    - Motion improves in extension



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    - Normal right sidebending motion
    - Resists translation the right
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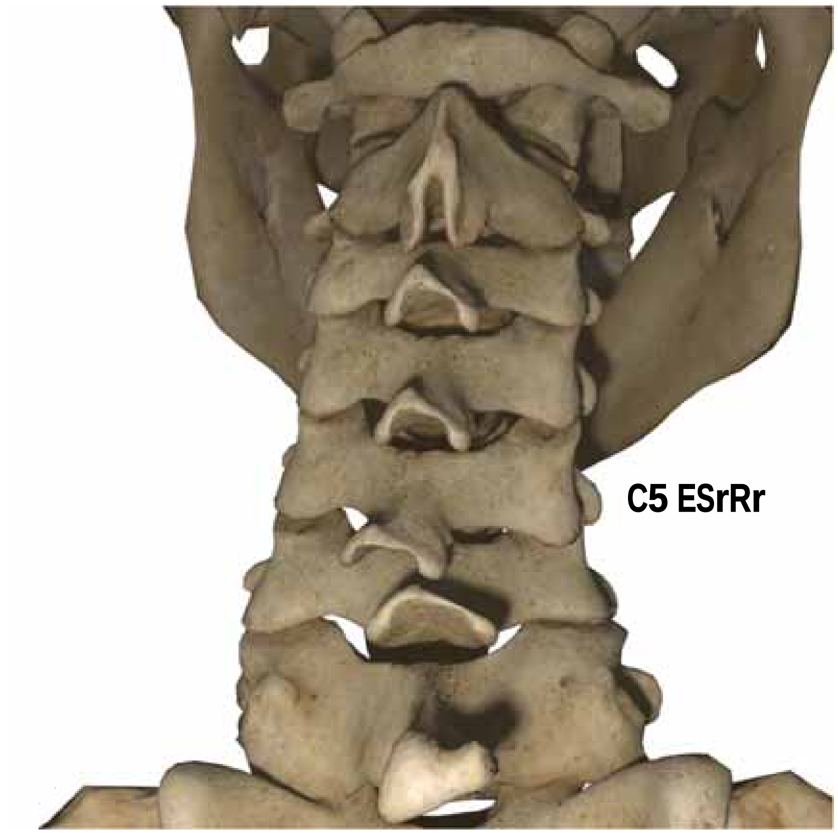
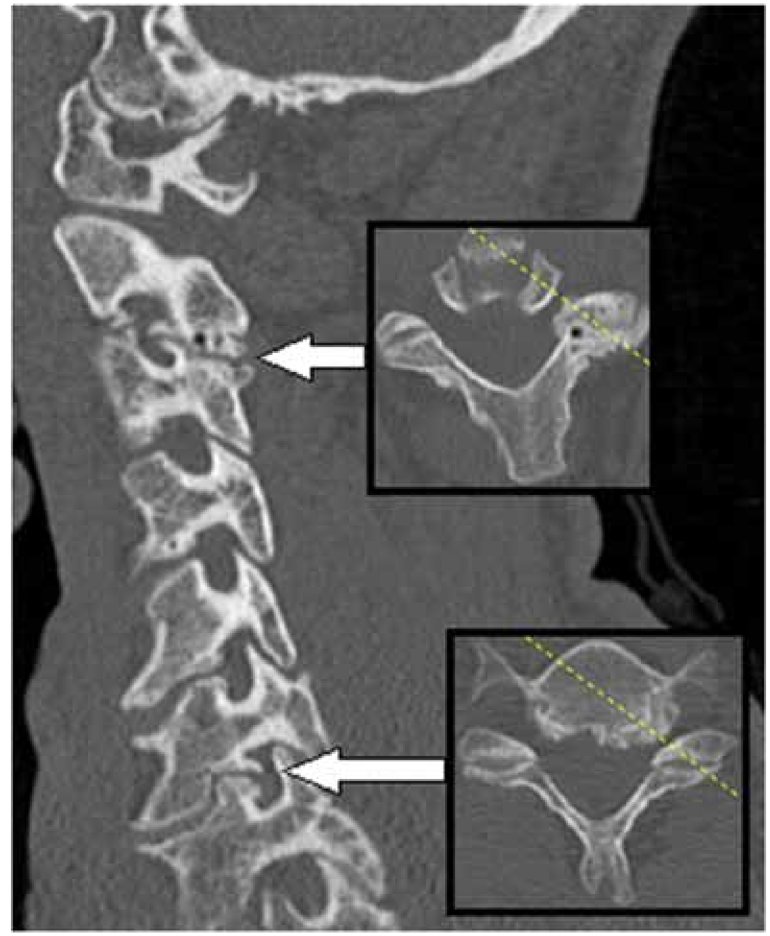
    - Motion improves in extension
    - Motion worsens in flexion



Typical Cervical Dysfunction

- Mechanical neck pain
- Headaches
- Wry neck/Torticollis
- Degenerative joint disease

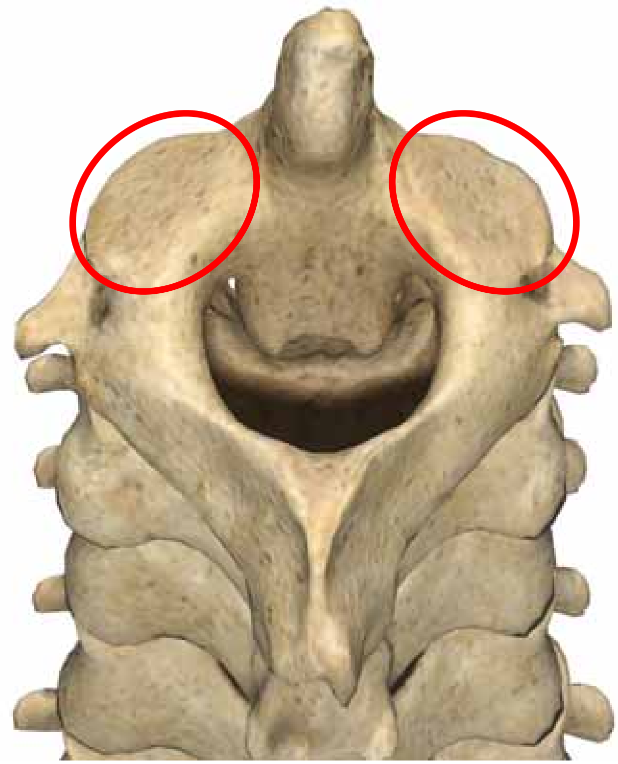


Atlantoaxial (AA) Mechanics

Atlantoaxial Mechanics

- Composed of 3 articulations
  - Laterally - two C1-C2 synovial facet joints
  - Midline - atlantodental joint

- Localized ROM
  - Primarily rotation
    - 55–77% of the total cervical spine rotation
    - Average unilateral rotation 33.1° (22.4–55.5°)
  - Small amount of flexion and extension are permitted
  - Minimal sidebending (lateral bending)



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Atlantodental Joint

Atlantoaxial Mechanics

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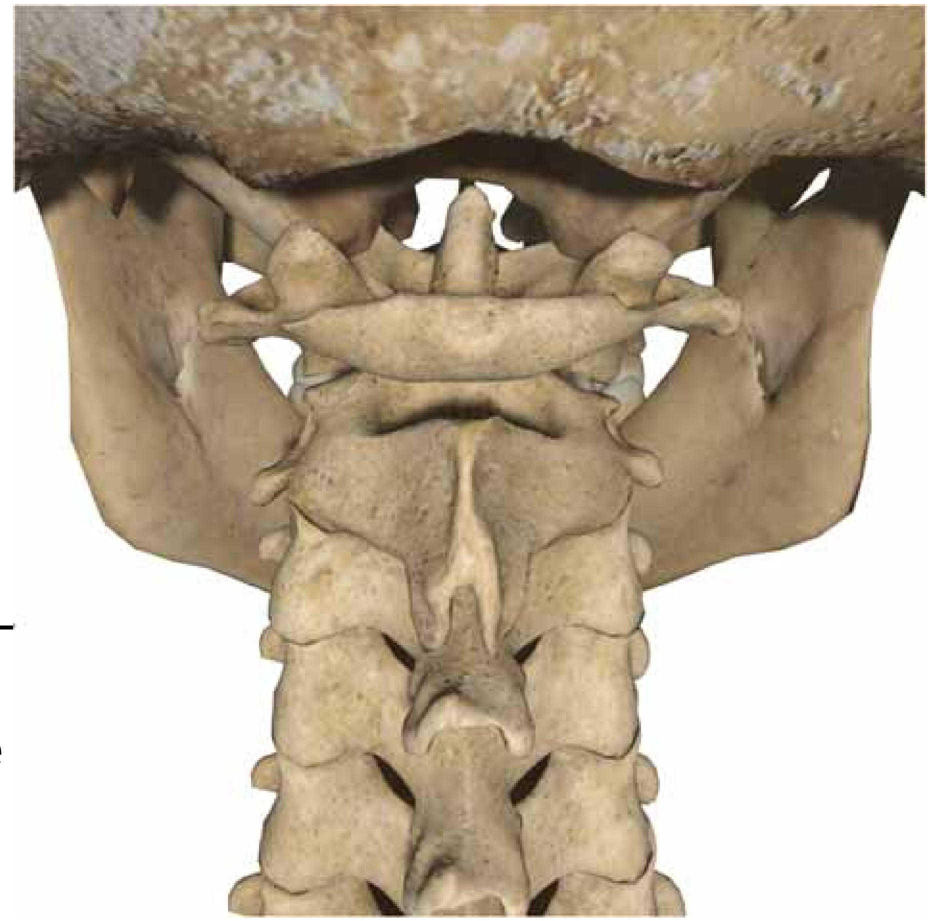

Diagnosing AA – Method 1

Assess for right and left rotation motion restriction and motion preference

Method 1 (Screen)

1. Markedly flex the cervical spine, rotate head left and right to physiologic barrier.
2. Identify direction of motion restriction and direction of ease of motion

When motion restriction is present, name dysfunction for motion preference

Method 1 – Flex the cervical spine

Assess right rotation

Assess left rotation

Lab Exercise: AA Method 1

Assess for right and left rotation motion restriction and motion preference

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Method 1 – Flex the cervical spine

Assess right rotation

Assess left rotation

Diagnosing AA – Method 2

Assess for right or left rotation motion restriction and motion preference

Method 2

1. Palpate lateral masses of C1 bilaterally
2. Rotate C1 left and right to physiologic barrier.
3. Identify direction of motion restriction and direction of ease of motion

When motion restriction is present, name dysfunction for motion preference

Method 2 – Assess rotation by rotating C1 to the left and right

Lab Exercise: AA Method 2

Assess for right or left rotation motion restriction and motion preference

Method 2

1. Palpate lateral masses of C1 bilaterally
2. Rotate C1 left and right to physiologic barrier.
3. Identify direction of motion restriction and direction of ease of motion

When motion restriction is present, name dysfunction for motion preference

Method 2 – Assess rotation by rotating C1 to the left and right

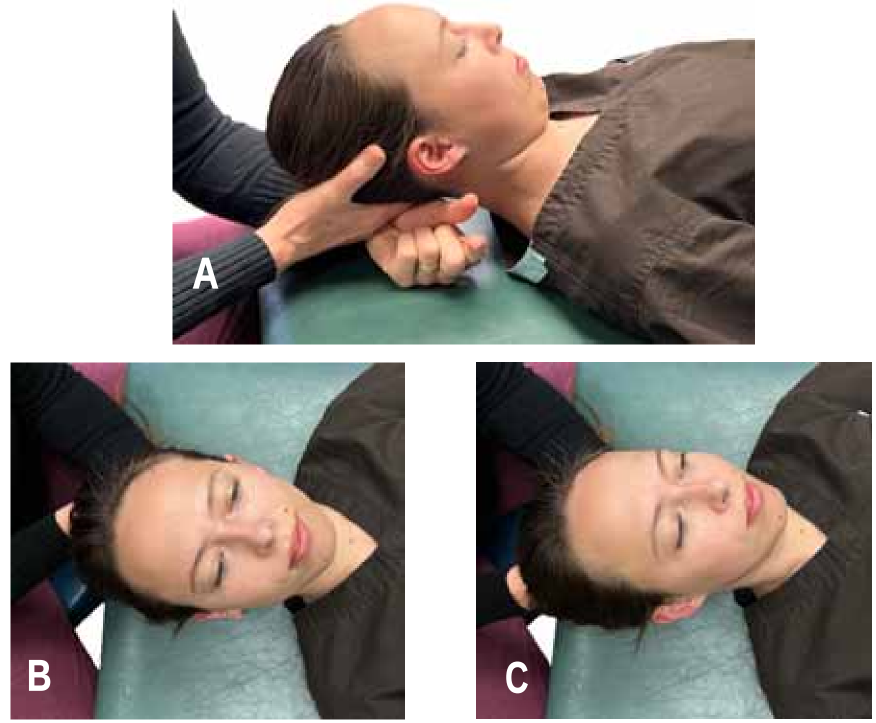
Diagnosing AA - Method 3

Assess for right or left rotation motion restriction and motion preference

Method 3

1. Stabilize C2 spinous process with a **“V” hold**.
2. Rotate the head and C1 left and right to physiologic barrier.
3. Identify direction of motion restriction and direction of ease of motion

When motion restriction is present, name dysfunction for motion preference



Method 3 – Assess rotation by rotating C1 to the left and right while stabilizing C2 with a V hold. A) V hold finger position. B) Assessing right rotation. C) Assessing left rotation

Lab Exercise: AA Method 3

Assess for right or left rotation motion restriction and motion preference

Method 3

1. Stabilize C2 spinous process with a “V” hold.
2. Rotate the head and C1 left and right to physiologic barrier.
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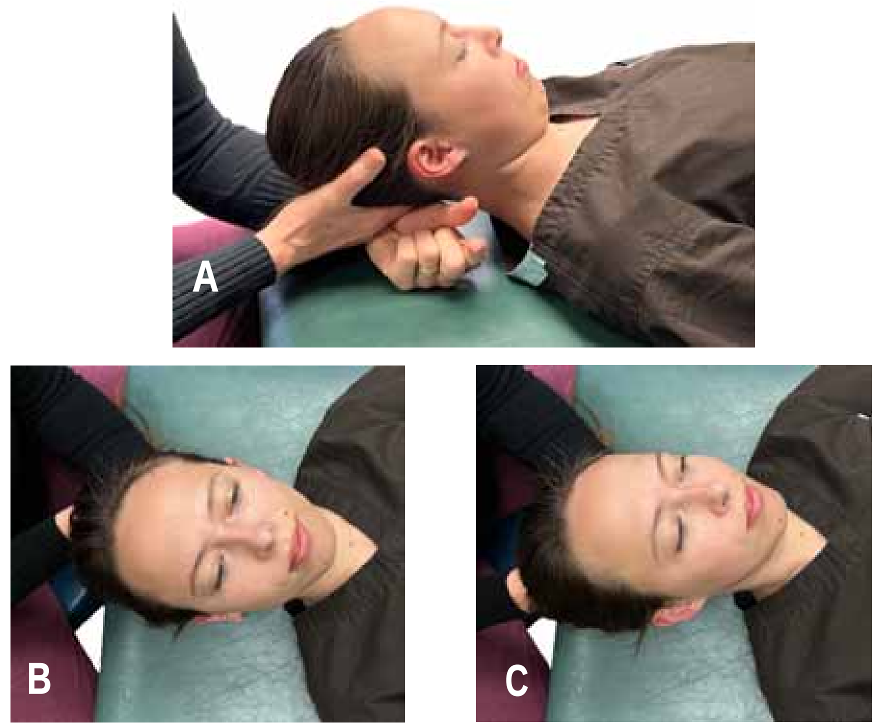

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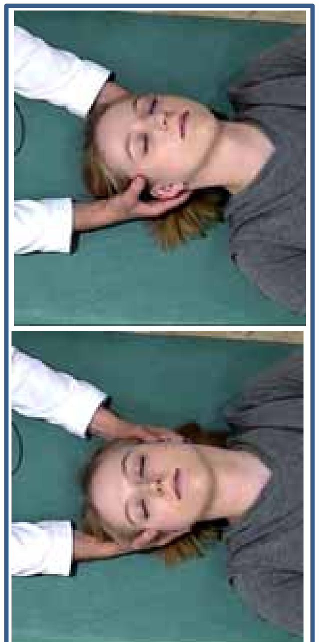
Lab Exercise - Diagnosing AA

Compare AA Methods

- Method 1 (Screen)
  1. Markedly flex the cervical spine, rotate head left and right to physiologic barrier.
  2. Identify direction of motion restriction and direction of ease of motion.
- Method 2 and 3
  1. Palpate lateral masses of C1 bilaterally or stabilize C2 with V hold.
  2. Rotate C1 left and right to physiologic barrier.
  3. Identify direction of motion restriction and direction of ease of motion.

Name for motion preference

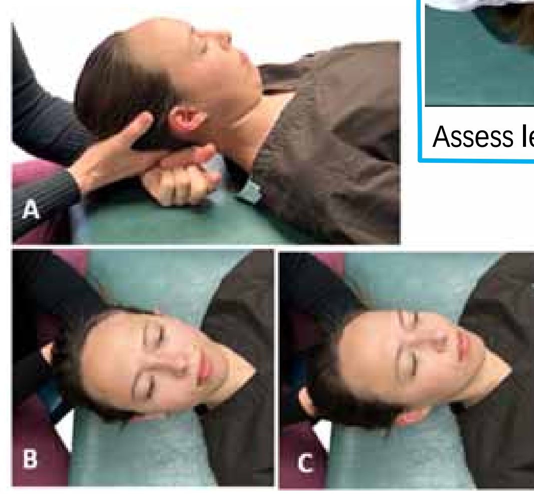


Method 2 – Assess rotation by rotating C1 to the left and right

Method 1 – Flex the cervical spine

Assess right rotation

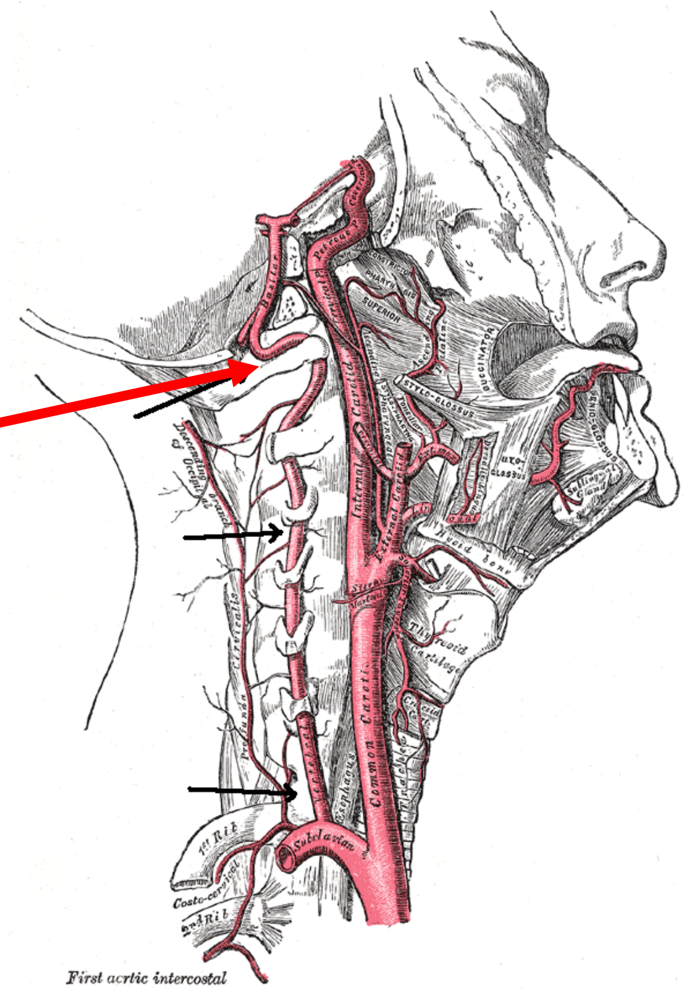
Assess left rotation



Method 3 – Assess rotation by rotating C1 to the left and right while stabilizing C2 with a V hold. A) V hold finger position. B) Assessing right rotation. C) Assessing left rotation

Atlantoaxial Dysfunction

- Articular dysfunction associated with
  - Upper neck pain
  - Headaches
- OMT Precaution
  - Vertebral artery insufficiency
    - OA, AA diagnosis and treatment precaution
  - Conditions prone to Dens degeneration, AA instability and dislocation
    - DJD, rheumatoid arthritis, Downs



Atlantoaxial Dysfunction

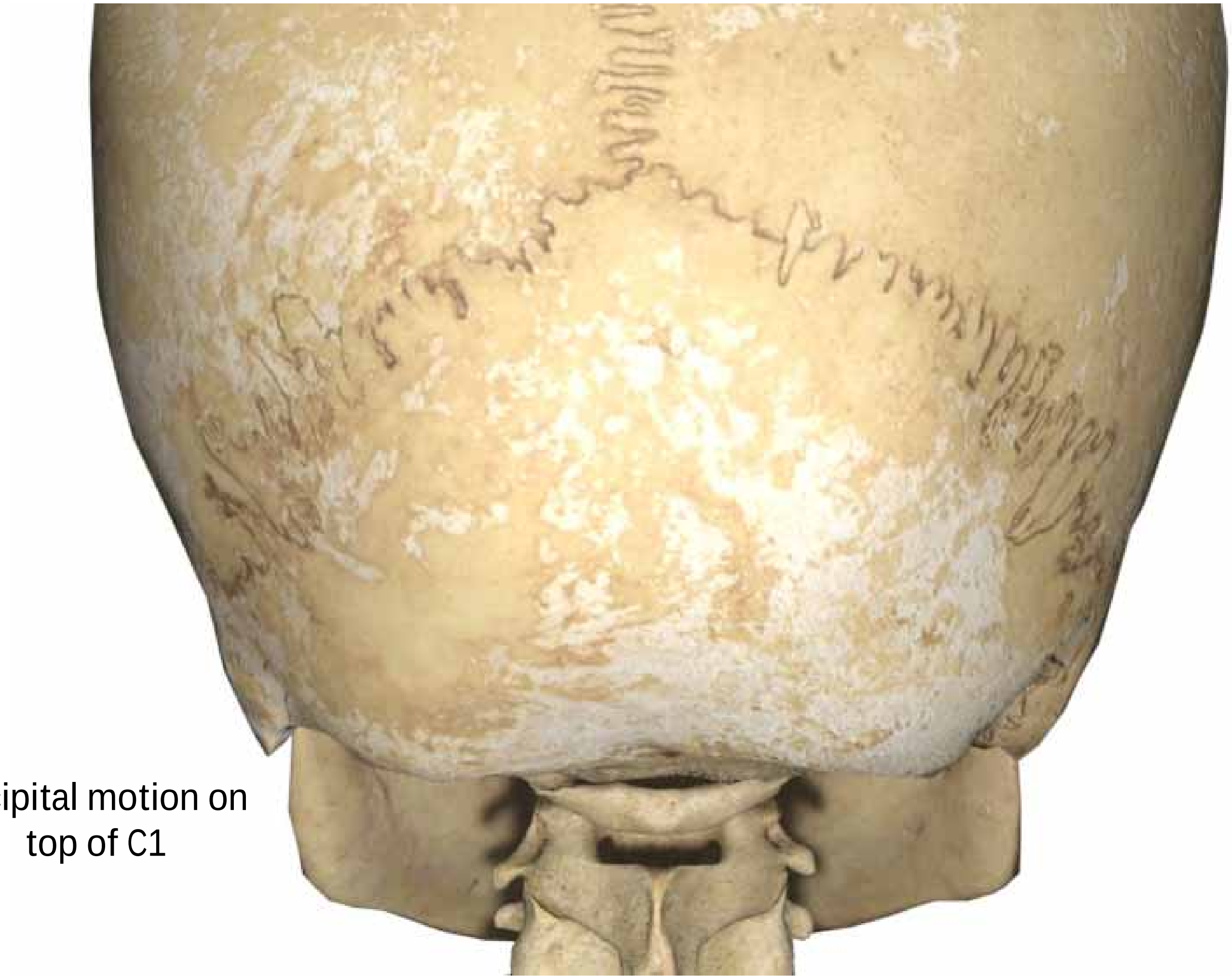
- Articular dysfunction associated with
  - Upper neck pain
  - Headaches
- OMT Precaution
  - Vertebral artery insufficiency
  - Conditions prone to Dens degeneration, AA instability and dislocation
    - DJD, rheumatoid arthritis, Downs

Unstable Dens can lead to AA subluxation

Occipitoatlantal (OA) Mechanics

Occipitoatlantal Mechanics

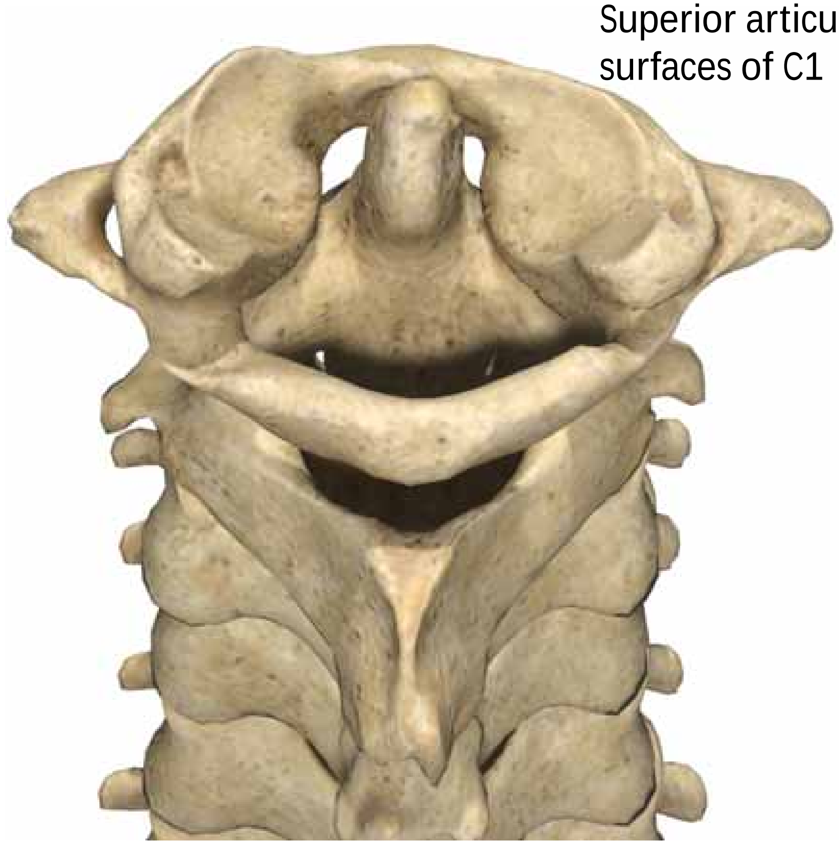
- OA joint (C1-C0)
- Head region
- Joint shape allows
  - Flexion and Extension
  - Sidebending and rotation occur to the opposite sides with some flexion or extension



Occipital motion on top of C1

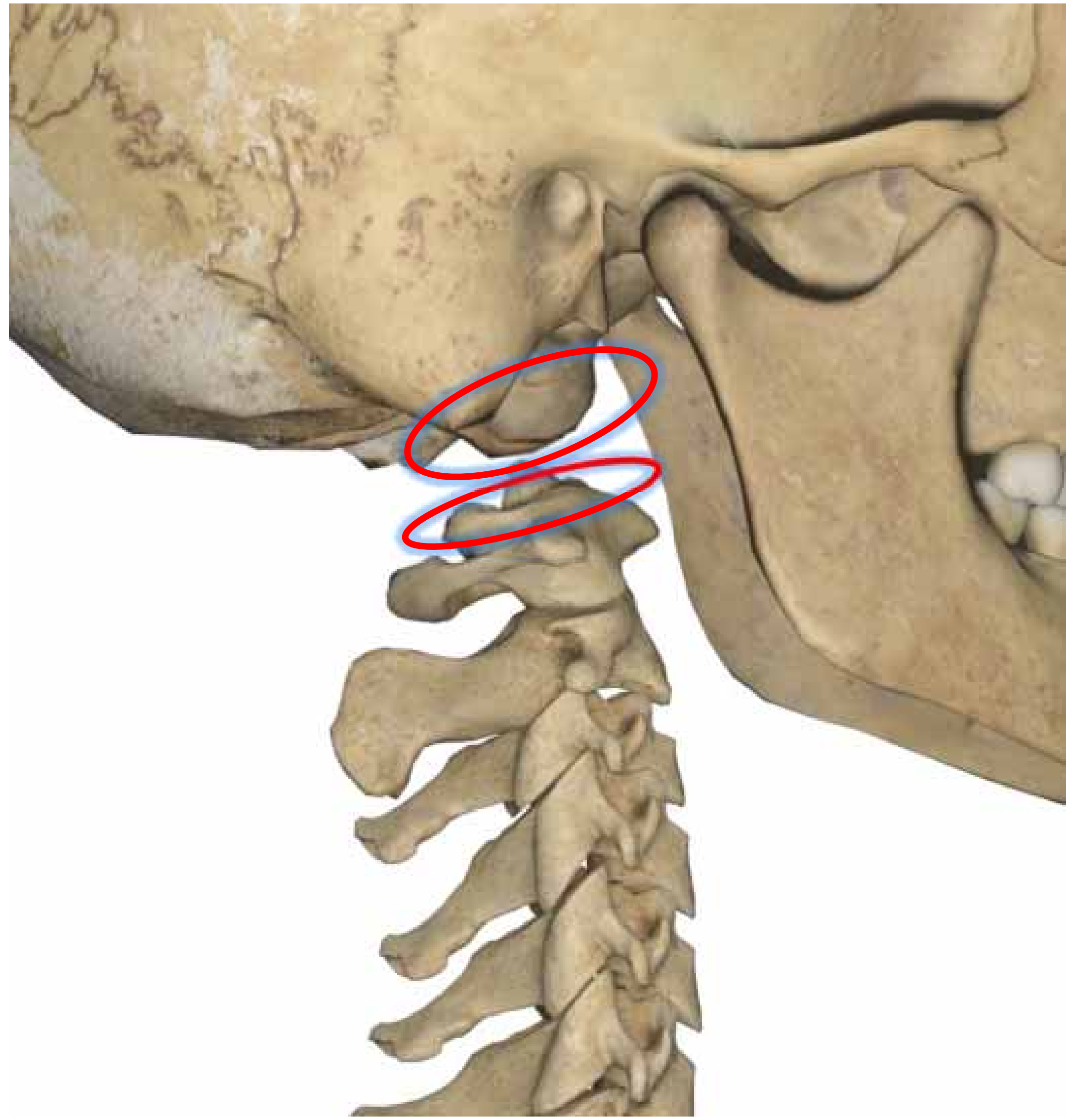
Occipitoatlantal Mechanics

- OA joint
  - 2 joints
- Head region
- Joint shape allows
  - Flexion and Extension
  - Sidebending and rotation occur to the opposite sides with some flexion or extension



Occipitoatlantal Mechanics

- OA joint
- Head region
- Joint shape allows
  - Flexion and Extension
  - Sidebending and rotation occur to the opposite sides with some flexion or extension



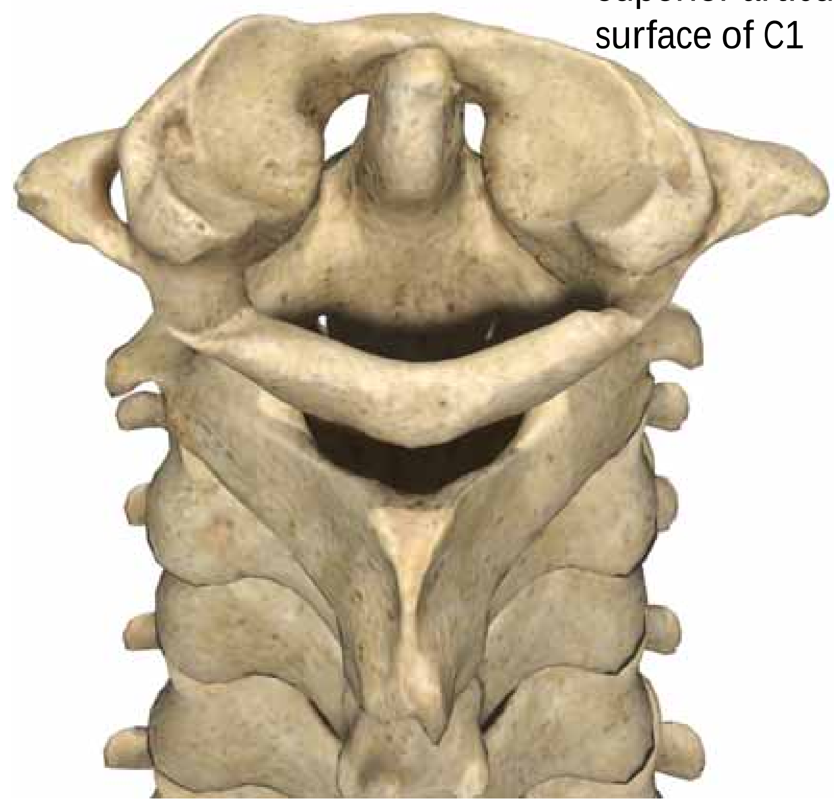
Occipitoatlantal Mechanics

- OA joint
- Head region
- Joint shape allows
  - Flexion and Extension
  - Sidebending and rotation occur to the opposite sides with some flexion or extension

- OA Flexion 10°
- OA Extension 20°

Occipitoatlantal Mechanics

- OA joint
- Head region
- Joint shape allows
  - Flexion and Extension
  - Sidebending and rotation occur to the opposite sides with some flexion or extension



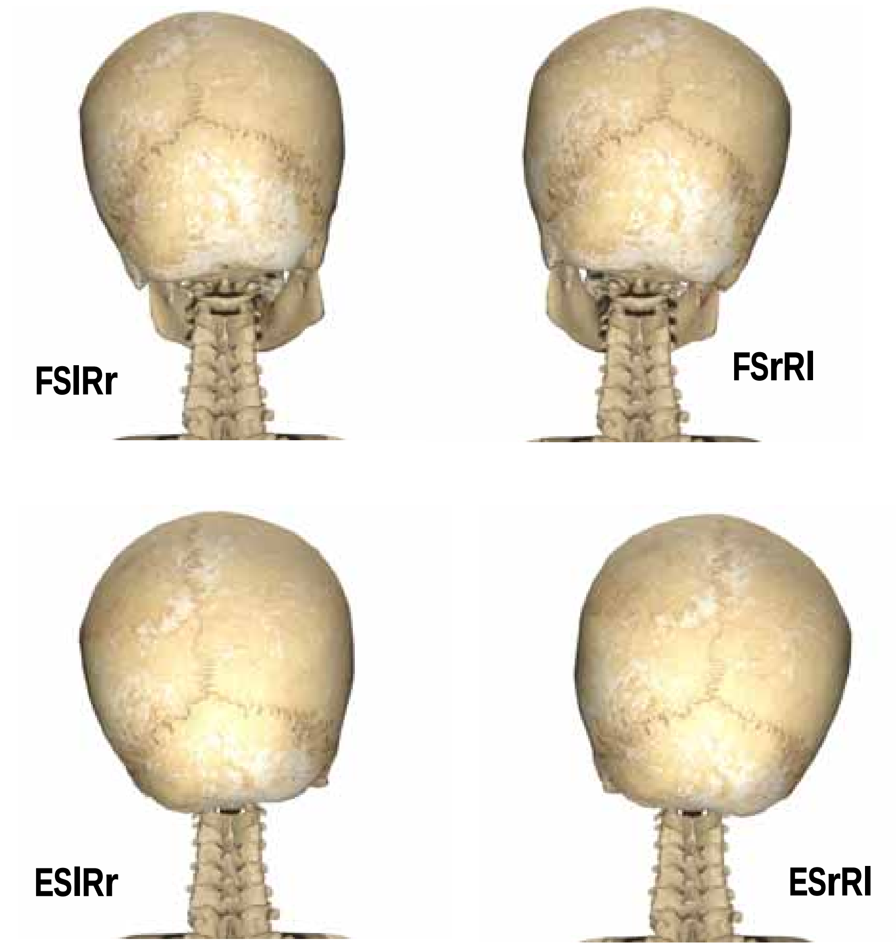
Occipitoatlantal Mechanics

- OA joint
- Head region
- Joint shape allows
  - Flexion and Extension
  - Sidebending and rotation occur to the opposite sides with some flexion or extension

- OA Sidebending – 8 °
- OA rotation - <5°

Occipitoatlantal Somatic Dysfunction

- Somatic Dysfunction
  - Flexed
  - Extended
  - Flexed, sidebent right, and rotated left (FSrRl)
  - Flexed, sidebent left, and rotated right (FSrRl)
  - Extended, sidebent right, and rotated left (ESrRl)
  - Extended, sidebent left, and rotated right (ESlRr)

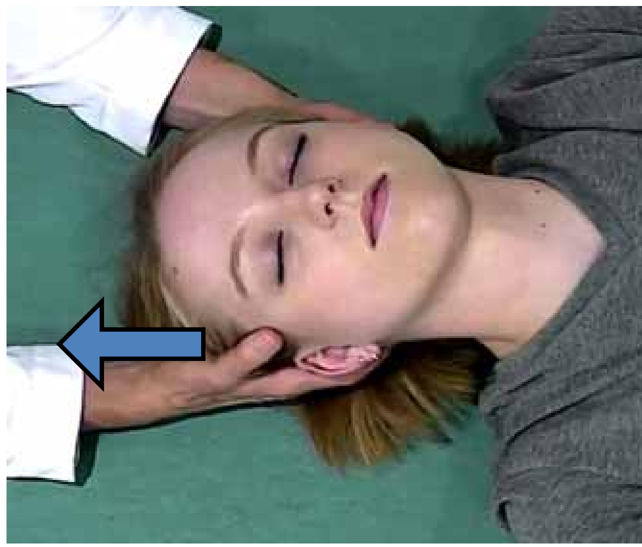


Occipitoatlantal Somatic Dysfunction

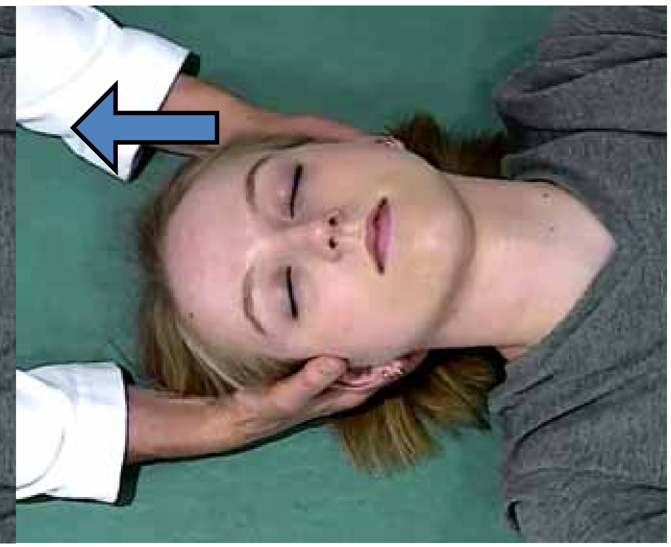
- Flexion and Extension coupled with rotation and sidebending to opposite sides

Sidebending

- Screen and Diagnosis
- Translation
  - Translation to right = left sidebending
  - Translation to the left = right sidebending



Pull superiorly on right occiput to assess left sidebending



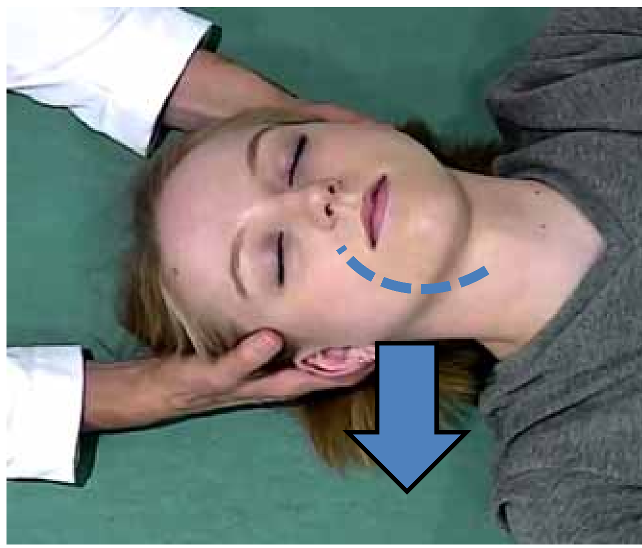
Pull superiorly on left occiput to assess right sidebending

Occipitoatlantal Somatic Dysfunction

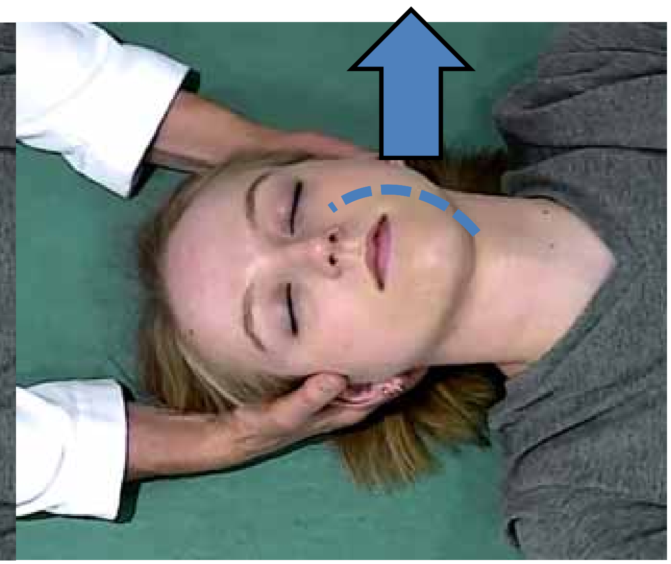
- Flexion and Extension coupled with rotation and sidebending to opposite sides

Sidebending

- Screen and Diagnosis
- Translation
  - Translation to right = left sidebending
  - Translation to the left = right sidebending



Translation to the right induces sidebending to the left



Translation to the left induces sidebending to the right

Occipitoatlantal Somatic Dysfunction

- Flexion and Extension coupled with rotation and sidebending to opposite sides

Rotation

- Static asymmetry
  - posterior prominence of occipital base
- Motion preference
  - Rotated to each side

Assessing left rotation

Assessing right rotation

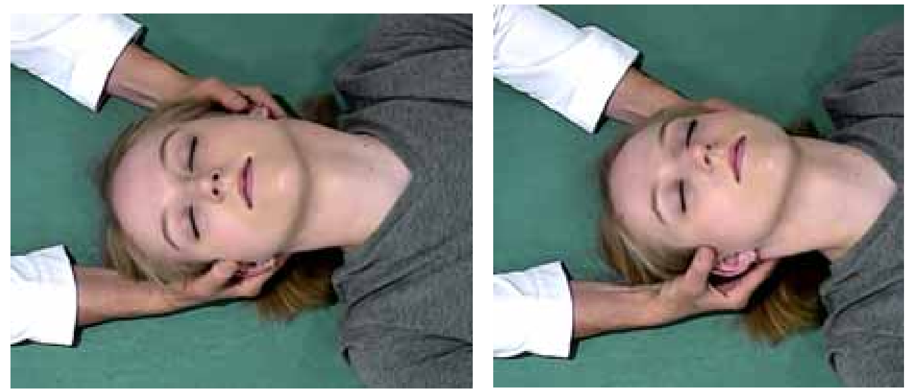
Occipitoatlantal Somatic Dysfunction

- Flexion and Extension coupled with rotation and sidebending to opposite sides

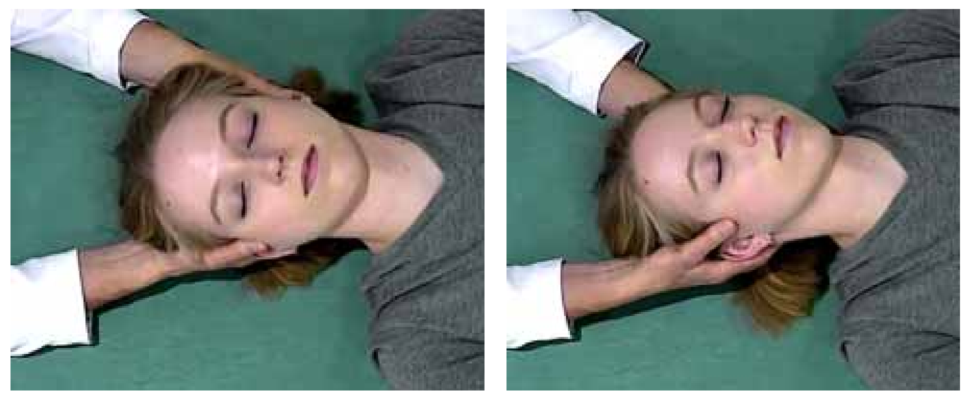
Sagittal Plane

- Flexion
- Extension

- Sidebending and rotation preference will be come less obvious in preferred sagittal motion position



Assessing sidebending and rotation with OA extension

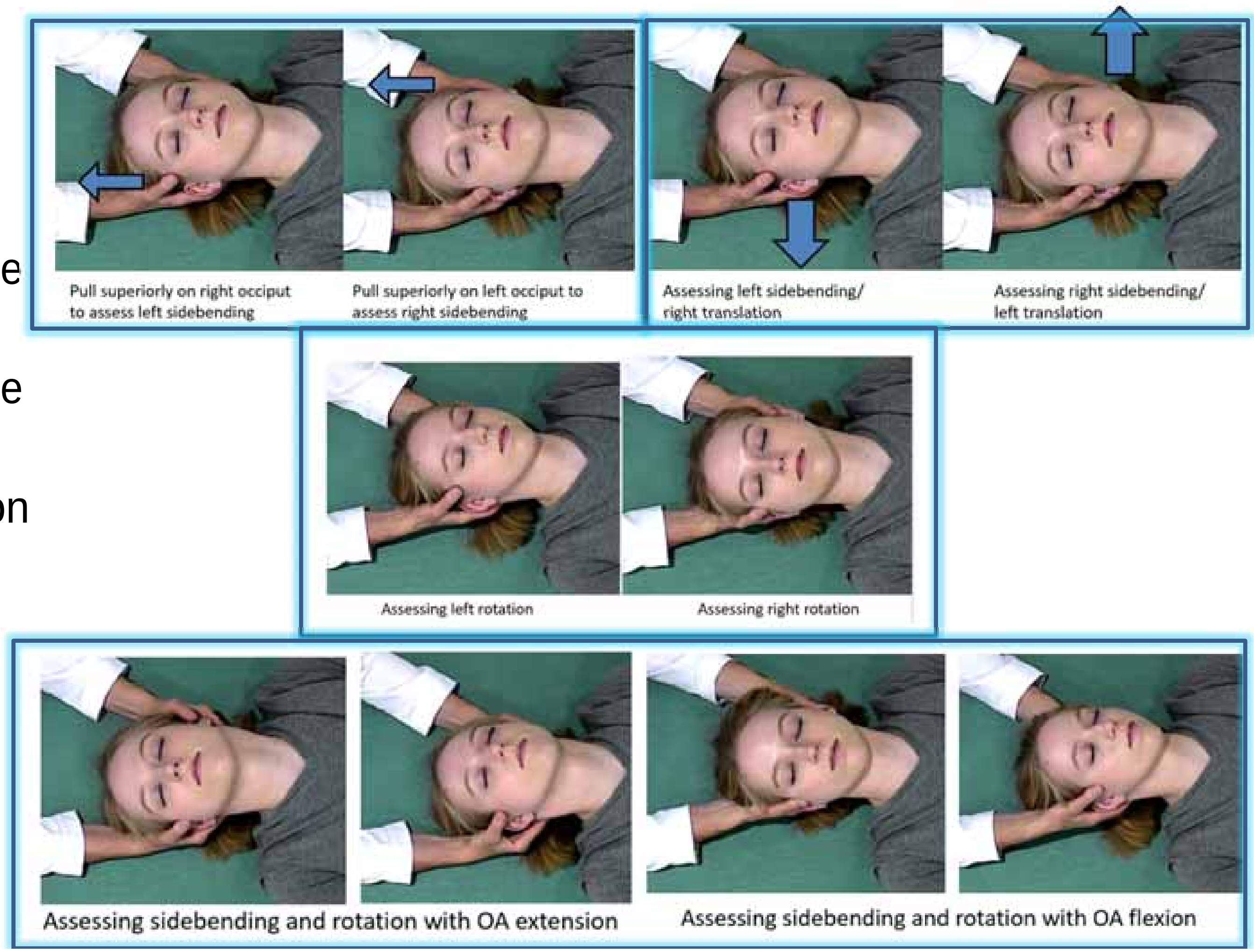


Assessing sidebending and rotation with OA flexion

Lab Exercise - OA Somatic Dysfunction

- Screen by pulling superiorly on right, then left occipital base
- Assess for sidebending motion restriction and motion preference
- Assess for rotation motion restriction and motion preference
- Reassess rotation and/or sidebending for motion restriction and preference in flexion and extension

- Name dysfunction based on the motion preference

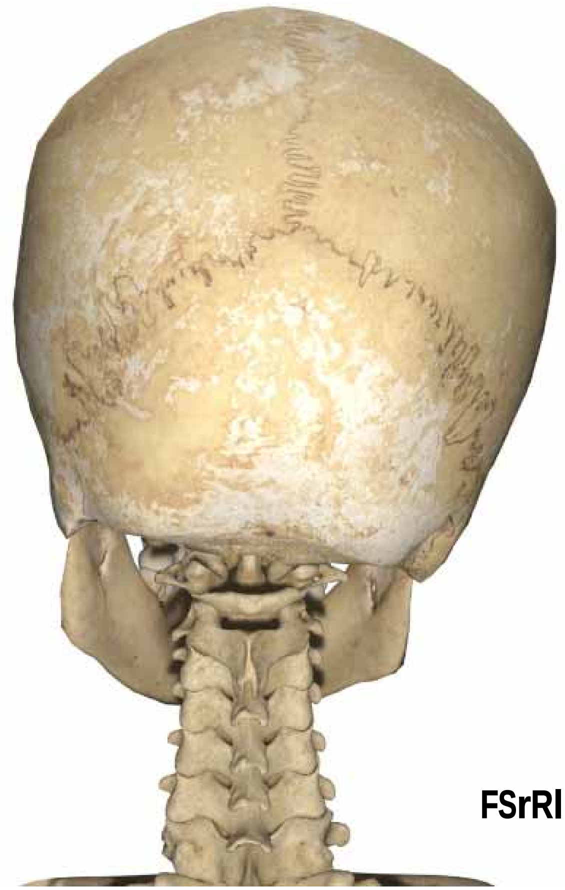


Diagnosing OA

Somatic dysfunction diagnosis is named for motion preference

OA flexed, sidebent right, and rotated left (FSrRl)

- Reduced left sidebending (right translation)
- Prefers right sidebending (left translation)
- Reduced right rotation
- Prefers left rotation
- Sidebending and rotation motion restriction not evident when occiput is flexed
- Sidebending and rotation motion restriction worse when occiput is extended



Occipitoatlantal Dysfunction

- OA Dysfunction
  - Tension headaches
  - Migraine headaches
  - Occipital neuralgia
  - Temporal bone dysfunction
    - TMJ dysfunction
    - Dizziness/vertigo
    - Ear infections
  - Impaired lymphatic drainage from the head


Questions?

References

- Chapter 27: Osteopathic Segmental Examination, Walter C. Ehrenfeuchter, Raymond J. Hruby Foundations of Osteopathic Medicine: Philosophy, Science, Clinical Applications, and Research, 4e. 2019
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- Lorente AI, Hidalgo-García C, Rodríguez-Sanz J, Maza-Frechín M, Lopez-de-Celis C, Pérez-Bellmunt A. Intersegmental Kinematics of the Upper Cervical Spine: Normal Range of Motion and its Alteration After Alar Ligament Transection. Spine. July 2021. doi:10.1097/BRS.0000000000004167