

CERVICAL SPINE

Arthrokinematics

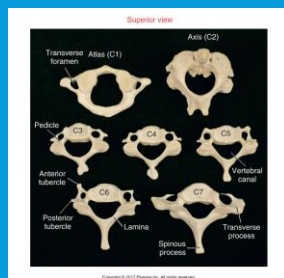
Dr Kate Williams

THE AIMS OF THIS SESSION

- By the end of this session students should be able to...
 - Discuss the anatomy of the cervical spine
 - Identify the movement available at the cervical spine
 - Vertebrae
 - Facets
 - Understand the normal kinematics of cervical movement in the different regions in preparation for manual therapy

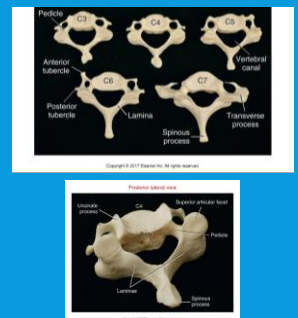
CERVICAL VERTEBRAE

- Smallest
- Most mobile
 - Large ROM required by the head
- Unique vertebrae
 - Transverse foramen within transverse process
 - Vertebral artery ascends to foramen magnum
 - Blood to brain and cord
 - Sits anterior to exiting spinal nerve roots



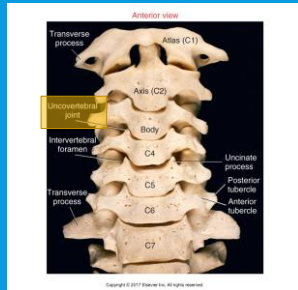
CERVICAL VERTEBRAE C₃-C₆

- C₃ – C₆ almost identical
- Small rectangular bodies
 - Dense, strong cortical shell
- Width > length
- Not flat
 - Superior surface
 - Concave side to side
 - Raised lateral sides/hooks
 - Uncinate processes



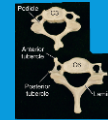
CERVICAL VERTEBRAE C₃-C₆

- Inferior surface
 - Concave A/P
 - Convex side to side
- Small, synovial lined uncovertebral joints
 - Formed between uncinete process and adjacent superior vertebrae
 - 'Joints of Luschka'
- Exact function unclear
 - Likely facilitate kinematics



CERVICAL VERTEBRAE C₃ – C₆

- Pedicles
 - Short, curved
- Laminae
 - Very thin
- Vertebral canal
 - Triangular
 - Large
 - Thickening of cord
 - Cervical & Brachial plexus
- Articular pillar
 - Continuous pillar of superior and inferior articular processes interrupted by the facet joints



CERVICAL VERTEBRAE C₃ – C₆

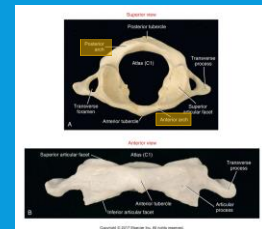
- Spinous processes
 - Short
 - Bifid (C₃)
- Transverse processes
 - Short lateral extensions
 - End in anterior and posterior tubercles
 - Unique
 - Attachments
 - Anterior scalene, levator scapulae, splenius cervicis



ATYPICAL VERTEBRAE C₁ – C₂



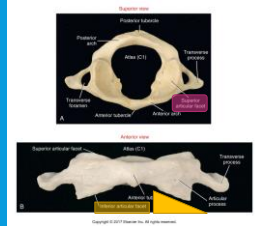
- Atlas (C₁)
 - Support the head
 - No body, pedicle, laminae or SP
 - Two large masses joined by anterior and posterior arches
- Anterior arch
 - Anterior tubercle
 - Anterior longitudinal ligament
- Posterior arch
 - Posterior tubercle



ATYPICAL VERTEBRAE C₁ – C₂

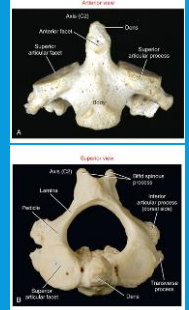
Atlas

- Superior articulating facet
 - Accept large convex occipital condyles
- Inferior articulating facet
 - Slopes laterally – 20°
- Large palpable TP's



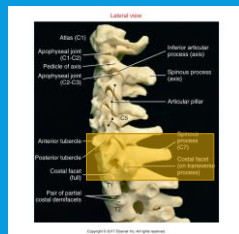
ATYPICAL VERTEBRAE C₁-C₂

- Axis (C₂)
 - Large, tall body
 - Basis for the upwardly projecting dens (Odontoid process)
 - Dens provides a rigid vertical axis of rotation for the atlas and the head
- Superior articular processes
 - Project laterally from body
 - Large
 - 20° orientation
- Pedicles
- Transverse processes
- Spinous process
 - Bifid & Broad



ATYPICAL VERTEBRAE C₇

- 'Vertebrae prominens'
- Largest of all Cxsp
- More characteristic of Txsp
- Large transverse process
- Large spinous process



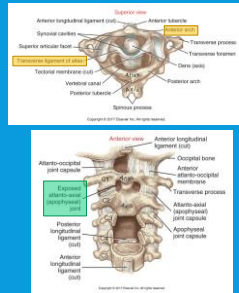
CERVICAL SPINE MOVEMENT

- Atlanto-occipital movement
 - Protruding convex condyles of occipital bone fitting with concave superior articulating facet of atlas
- Structural stability
- Anterior capsule blends with anterior atlanto-occipital membrane
- Posterior capsule blends with posterior atlanto-occipital membrane
- Vertebral artery pierces the posterior membrane to enter the foramen magnum
- Two degrees of freedom
 - Flexion / Extension
 - Lateral flexion is slight
 - Rotation severely restricted



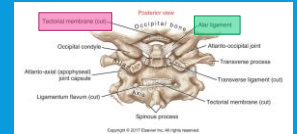
CERVICAL SPINE MOVEMENT

- Atlanto-axial joint complex
 - C₁ – C₂
- Median joint
 - Dens of axis (C₂) projecting through the osseous-ligamentous ring of atlas (C₁)
- 2 x apophyseal/facet joints
 - Inferior articular facets of atlas with superior facet of axis
- Two degrees of freedom
 - ~50% of rotation
 - Flexion-extension
 - Lateral flexion very limited



CERVICAL SPINE MOVEMENT

- Tectorial membrane
- Alar ligaments

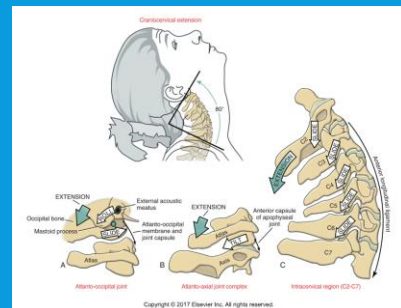


CERVICAL SPINE MOVEMENT

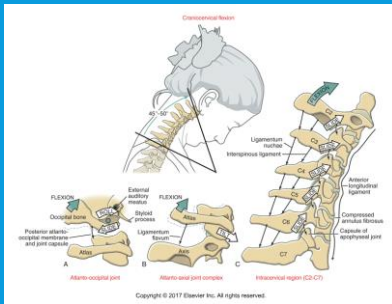
- Sagittal plane movement
 - 120-130° combined FLXN & EXTN across craniocervical region
- Neutral
 - 30-35° EXTN (remember start position of lordosis!)
- Further EXTN of 75-80°
- FLXN 45-50°
- EXTN > FLXN by margin of 1.5 to 1
- Limited by soft tissue (muscles and connective tissue)
- FLXN limited by annulus fibrosus
- 20-25% of total FLXN & EXTN occurs at occipital-C₁-C₂ region
- Remainder occurs across C₂-C₇
- Volume of cervical vertebral canal is greatest in full flexion, and least in full extension
 - SC more vulnerable in hyper-extension especially with stenosis



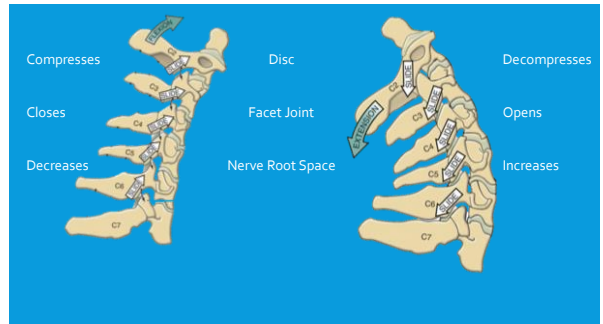
CERVICAL SPINE MOVEMENT



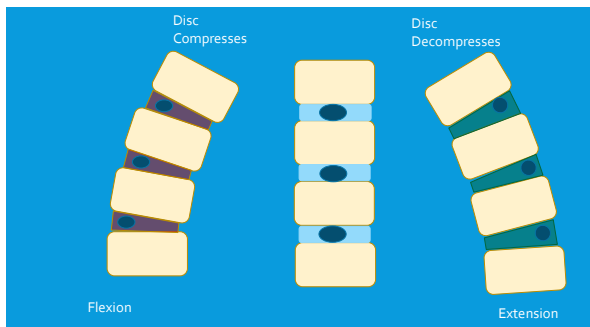
CERVICAL SPINE MOVEMENT



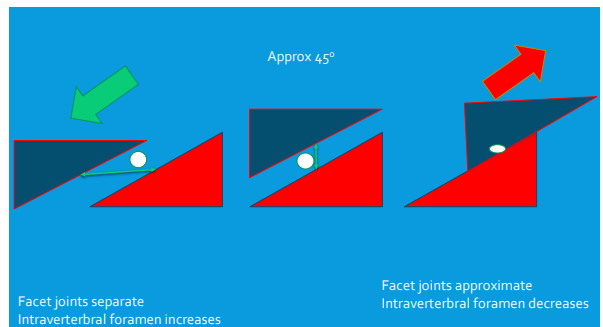
CERVICAL SPINE MOVEMENT



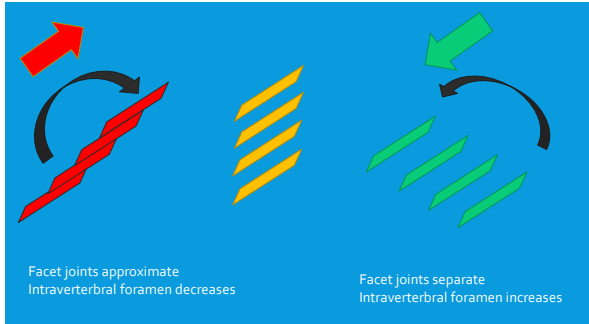
CERVICAL SPINE MOVEMENT



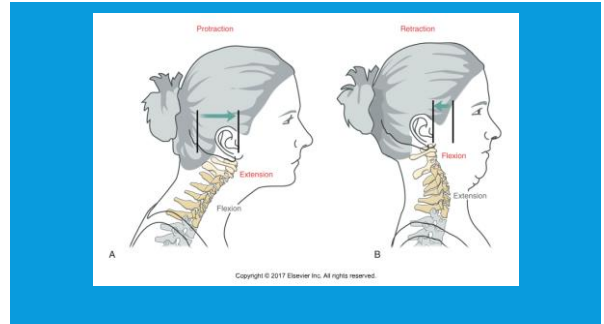
CERVICAL SPINE MOVEMENT



CERVICAL SPINE MOVEMENT

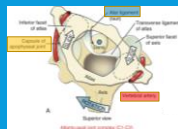


CERVICAL SPINE MOVEMENT



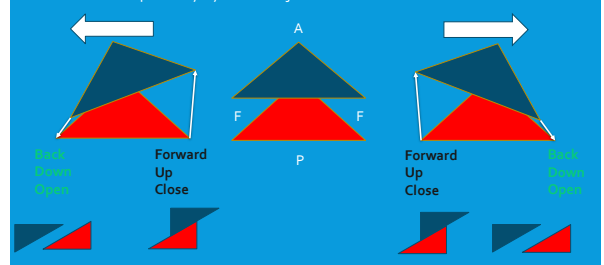
CERVICAL SPINE MOVEMENT

- Horizontal plane movement (Rotation)
 - Inherently linked to vision and hearing
 - Full ROM 65-75° unilateral rotation
 - Varies with age
 - ~50% occurs at atlantoaxial joint complex
 - Restricted by occipital condyles and superior articular facets of atlas
 - Vertical dens and near horizontal superior articular facets
 - 35-40° rotation each side



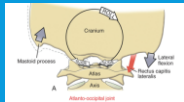
CERVICAL SPINE MOVEMENT

- Intracervical movement (C2-C7)
 - Guided primarily by the facet joints

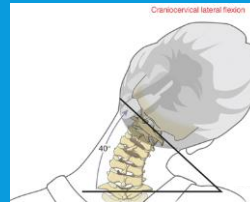


CERVICAL SPINE MOVEMENT

- Side flexion (RSF/LSF)
 - 35-40° side flexion available throughout craniocervical region
 - 5° at atlanto-occipital joint
 - Atlanto-axial joint complex negligible
 - 30-35° at C2-C7
- Atlanto-occipital joint
 - Small amount of side to side rolling
 - Convex-concave rule
 - Roll towards side flexion, slide away from side flexion



CERVICAL SPINE MOVEMENT



CERVICAL SPINE MOVEMENT

Joint/Region	Flexion & Extension Sagittal plane (°)	Axial Rotation Horizontal plane (°)	Lateral Flexion Frontal plane (°)
Atlanto-occipital joint	FLXN: 5 EXTN: 10 TOTAL: 15	Negligible	~ 5
Atlanto-axial joint complex	FLXN: 5 EXTN: 10 TOTAL: 15	35-40	Negligible
Intracervical region (C2-C7)	FLXN: 35-40 EXTN: 55-60 TOTAL: 90-100	30-35	30-35
Total across craniocervical region	FLXN: 45-50 EXTN: 75-80 TOTAL: 120-130	65-75	35-40