

THORACIC SPINE

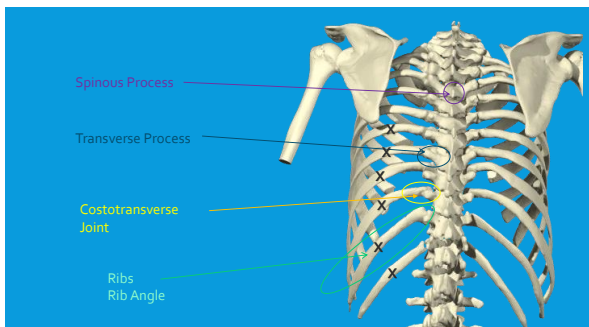
Arthrokinematics

Dr Kate L Williams

SESSION AIMS ...

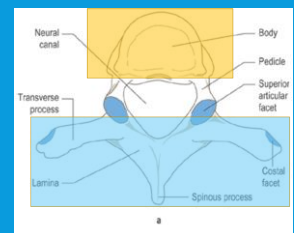
- By the end of this session students should be able to...
 - Explain the bony anatomy of the thoracic spine
 - Describe the movement of the thoracic spine
 - Vertebral body
 - Facet joints
 - Ribs
 - Apply awareness of normal ranges of movement to clinical setting

THORACIC ANATOMY



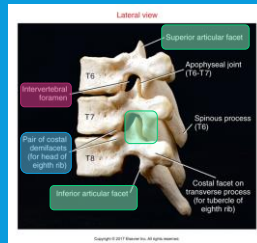
TYPICAL THORACIC VERTEBRAE

- T2 – T9
 - Similar features
- Pedicles
 - Directed posteriorly from the body
 - Vertebral canal is therefore narrower than Cxsp
- Transverse Processes
 - Project postero-laterally
 - Each contain a costal facet
 - Articulates with corresponding rib
 - Costotransverse joint
- Laminae
 - Thick
 - Broad base for downward slanting spinous process



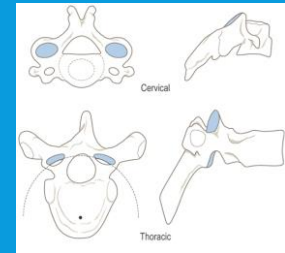
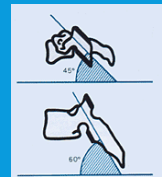
TYPICAL THORACIC VERTEBRAE

- Facet Joints
 - Superior and inferior facets are orientated vertically with a slight forward pitch.
- Head of rib articulates with a costal demi-facet
 - Costocorporeal joint
 - Span thoracic intervertebral junction
- Thoracic spinal nerve exits through corresponding thoracic IV foramen
 - Anterior to facet/apophyseal joint



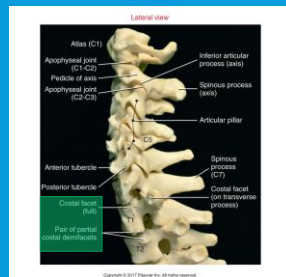
ZYGAPOPHYSEAL/ FACET JOINTS

- 60° angle and curved inward along curve of rib



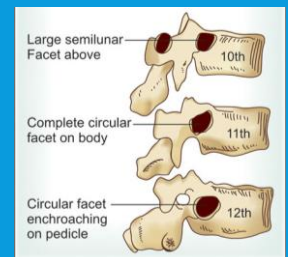
ATYPICAL THORACIC VERTEBRAE

- T₁
- Considered atypical because of the rib attachment
- Full costal facet accepts head of 1st rib
- Demi facet inferiorly that accepts ½ of the head of the 2nd rib



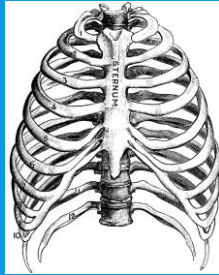
ATYPICAL THORACIC VERTEBRAE

- T₁₀-T₁₂
 - May have a single full costal facet
 - Articulates with head of 10th, 11th and 12th ribs
 - T₁₀-12 may also lack costotransverse joint
 - Rib & transverse process



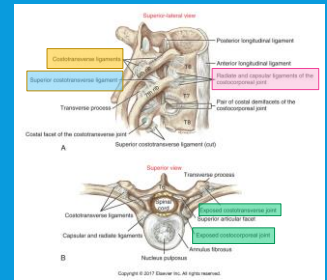
THORACIC MOVEMENT

- Relatively rigid rib cage
 - Ribs
 - Thoracic vertebrae
 - Sternum
- Rigidity
 - Stable base for muscles to control craniocervical region
 - Protection of intrathoracic organs
 - Mechanical bellows for breathing



THORACIC MOVEMENT

- 24 apophyseal/ facet joints
- Articular facets
 - Frontal plane $\sim 60^\circ$
 - Range from $15\text{--}25^\circ$ from vertical
- Movement limited by costotransverse and costocorporeal joints
- Costocorporeal joint held by capsule and radiate ligaments
- Costotransverse joint held by articular capsule and costotransverse ligament



RIBS

- Stability
- Rib cage + sternum provides 20-40% total passive resistance to full thoracic ROM
- Presence of ribs and sternum protect thoracic spine & cord
- Impact usually dissipated by the rib cage
- High frequency of Txsp injuries with concurrent sternal fracture



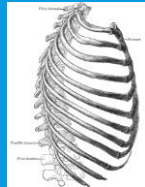
THE IMPORTANCE OF THE FIRST RIB

- Subclavian Artery Groove
 - Subclavian artery
 - Lower brachial plexus trunk
- Subclavian vein (Anterior Scalene)
- Attachments
 - Anterior **scalene** muscle: scalene tubercle
 - Middle **scalene** muscle: between groove for the subclavian artery and transverse tubercle
 - Intercostal muscles: from the outer border
 - Subclavius muscle: arises from the distal shaft and first costal cartilage
 - First digitation of the **Serratus Anterior** muscle
 - Costoclavicular ligament: anterior to the groove for the subclavian vein



THORACIC KINEMATICS

- In standing
 - Natural kyphosis of 40-45°
- Movement in all 3 planes
 - ROM typically small at each segment
 - Cumulatively motion across the Txsp considerable
- ROM influenced by several factors:
 - Resting posture
 - Apophyseal/facet joints
 - Rib cage articulations
 - Heights of intervertebral discs

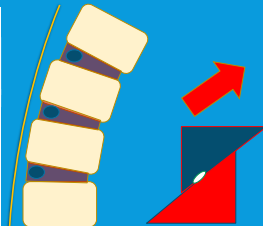
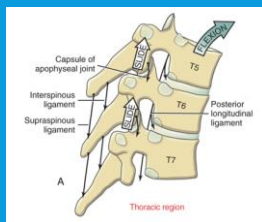


THORACIC KINEMATICS

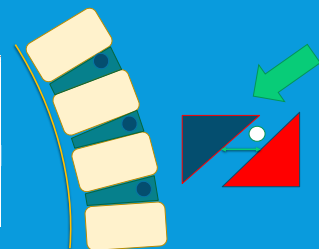
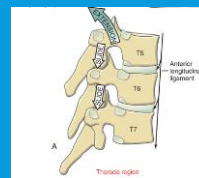
- FLXN
 - 30-40° throughout
 - Extremes of FLXN limited by
 - Tension in connective tissues on posterior of vertebral bodies
 - Facet joint capsule
 - Supraspinous and posterior longitudinal lig
- EXTN
 - 20-25° throughout
 - Extremes of EXTN limited by
 - Tension in anterior longitudinal lig
 - Potential impingement between laminae or adjacent SPs

More ROM in the caudal region due to free 'floating' ribs & changes to the angle of the facet joints

THORACIC KINEMATICS



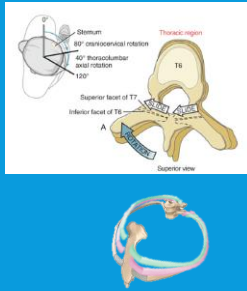
THORACIC KINEMATICS



THORACIC KINEMATICS

• Rotation

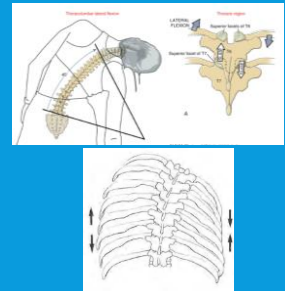
- Approximately 30-35° of rotation to each side
- Segmental contribution to rotation is greatest in the upper thoracic vertebrae and lowest in the lower thoracic vertebrae
- Due to apophyseal/facet joint angle
- Closer to vertical orientation in lower Txsp



THORACIC KINEMATICS

• Side Flexion

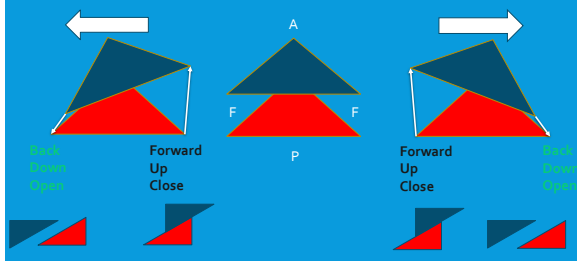
- If we only consider the thoracic vertebrae there is a large freedom of movement in to side flexion available
- However, never fully achieved due to the rib attachments
- 25-30° each side
- Ribs drop slightly on the side of lateral flexion and rise slightly on the opposite side.



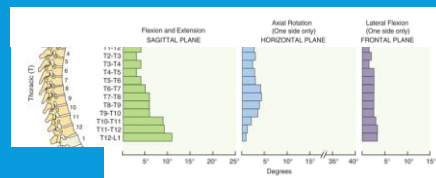
THORACIC KINEMATICS

LSF or LRot

RSF or RRot

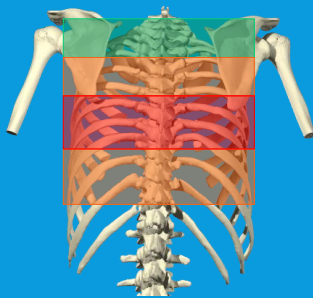


MOVEMENT SUMMARY



MAITLAND MANUAL THERAPY

- Orientation around Txsp more difficult than Cxsp
- Txsp TPs are not always level with SPs
- Need a road map to ensure continuity
- Locate C7 (vertebrae prominens)
- Rule of Three



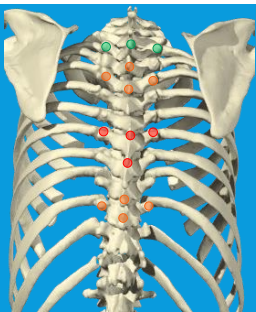
THORACIC SPINE (RULE OF 3)

- Spinous Process and Transverse Process NOT level in Txsp

Rule of three:

- | | LEVEL |
|---|-------------|
| • T1-T3: TP level with SP | |
| • T4-T6: TP half way between SP of vertebra in question and the one above | HALFWAY + |
| • T7-T9: TP level with SP of vertebra above | ONE LEVEL + |
| • T10-T12: TP half way between SP of vertebra in question and the one above | HALFWAY + |

RULE OF THREE



THORACIC KINEMATICS SUMMARY

FLXN & EXTN	LRot & RRot	RSF & LSF
Flexion 30-40°		
Extension 20-25°		
Total 50-65°	30-35°	25-30°