Anatomy and Kinesiology of the Thoracic Spine

Review of the basics before we get down to assessment and diagnosis

**Applied Anatomy**

- 12 vertebrae
- 12 pairs of ribs
- Costovertebral joints
- Costotransverse joints
- Costosternal joints
- Interchondral/intercostal joints
- Facet joints
- Intervertebral discs

**Thoracic Vertebrae**

- Similar in basic make-up to the lower cervical and lumbar vertebrae
- Possess longer spinous processes which overlap considerably
- Design of the vertebrae lead to a natural mild kyphosis
- Contains less motion than either the lumbar or cervical regions

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Facet Joints of the Thoracic Spine

- **Resting position:** Midway between flexion and extension
- **Close packed position:** Extension
- **Capsular pattern:** Side flexion and rotation equally limited, then extension

The Ribs

- 12 pairs of ribs
- Lowest pairs (11th and 12th) do not have an anterior attachment – Floating Ribs
- Middle pairs (8th - 10th) attach to sternum via a combined cartilaginous attachment – False Ribs
- Uppermost pairs (1st-7th) have bony attachments both anteriorly and posteriorly

Intercostal Muscles

- Muscles run between ribs in pairs
- Internal intercostals extend from the front of the ribs, and go posteriorly past the rib angle.
- External intercostals (on the outside of the ribcase) wrap around from the back of the rib almost to the end of the rib anteriorly.
- Diagonal direction improves elevation of the ribs during respiration.

Costovertebral Joints

- Synovial joints
- Head of the rib articulates with the vertebral body below, the intervertebral disc and the vertebral body above.
- 7th rib articulates with the 7th and 8th vertebral bodies as well as the intervening disc.

Costotransverse Joint

- Synovial joints
- The tubercle of the rib articulates with the transverse process of the thoracic vertebra
- The 11th and 12th ribs do not articulate in this way
- They are free floating ribs
- Pain on respiration may mean either costotransverse and/or costovertebral joints could be affected
Costosternal Joints
- The 1st rib articulates with the manubrium as a cartilaginous joint
- All the other articulations are synovial joints
- Ribs 2-7 articulate with the sternum
- Ribs 8-10 are united to the 7th rib by cartilage as an interchondral joint

Intervertebral Discs
- Thin
- There are usually very few disc problems in thoracic spine
- Those that do present tend to clear quickly and have an easily identifiable cause

Facet Joints
- The shape and orientation of the facets determines the movement
- Superior facets face posteriorly, superiorly and slightly laterally
- Inferior facets face anteriorly, inferiorly and slightly medially
- Rotation is greatest movement

Movements of The Thoracic Spine
- Limited By
  - The rib cage
  - The costotransverse and costovertebral joints
  - The facet joints
  - The thin IV discs
  - The shape and proximity of spinous processes

Thoracic Movement
- Very few studies have been done on thoracic spine movements
- Main movement of the thoracic spine is rotation
- Rotation and side flexion are coupled in the thoracic region.

Thoracic Movement
- Amount of flex and ext, and lateral flexion increases from T1-2 to T11-12
- The amount of rotation decreases
- T1 is the least mobile vertebrae
- T12-L1 is a very mobile transitional point
**Movements**

- **FLEXION** - anterior sagittal rotation and translation, ribs stretch at CT and CV joints

- **EXTENSION** - occurs with backward bending or elevation of the arms. Posterior sagittal rotation and translation with compression of CT and CV joints

**Movements**

- **ROTATION** - Superior vertebrae will rotate to the right and pull the rib with it.

- **SIDE FLEXION** - elevation of ribs on the opposite side to the movement

**Movements of the Ribs**

- The ribs are relatively horizontal at the top of the rib cage.
- As they descend they run more obliquely.
- The 12th rib is more vertical than horizontal.
- Inspiration draws the ribs upwards and outwards, thus increasing the antero-posterior diameter of the rib cage.

**Movements of the Rib Cage T1-6**

- During inspiration the first 6 ribs rotate about their long axis.
- Downward rotation of the rib neck is associated with depression.
- Upward rotation of the same portion is associated with elevation.
- This gives rise to the Pump Handle Action.

**Movements of the Rib Cage T7-10**

- Ribs 7-10 mainly increase in lateral direction.
- The ribs move upwards, backwards and medially.
- This is known as the Bucket Handle Action.

**Movements of the Rib Cage T11-12**

- The lower ribs move mainly laterally in what is referred to as the Caliper Action.
- This increases lateral diameter.
- The ribs are quite elastic in children but they eventually become hard and brittle.
Possible Sources Of Pain

- Vertebrae
- Dura
- IV discs
- Posterior longitudinal ligament
- Posterior thoracic muscles
- CT and CV joints
- Facet joints
- Nerve root compression

Patterns of Referred Pain

- Need to diagnose difference between visceral and spinal referred pain
- Chest pain - cardiac, pulmonary, pleural disease, oesophagus
- Angina - may affect face, jaw, and neck
- Hiatus hernia
- Abdominal
- Gynaecological

Pain Referral

- Thoracic pain “shooting through” - disc
- Pain referred horizontally around chest - Synovial joint
- Pain referred down and around chest wall - root involvement (Grieve 1981)

Kyphosis

- Most common condition in the thoracic region
- Slight posterior curvature of the thoracic spine is normal
- PT must ensure an excessive curvature or kyphosis is present

Kyphosis

- Very often reducible and easily managed
- Occasionally may require surgical intervention
- Will be discussed next week

Any Questions?