Posture
Vertebral Alignment
Does it really matter? Yes it does!
Postural Curves

Convex & Concave

- the reference point is the posterior aspect

- Cervical Lordosis
- Thoracic Kyphosis
- Lumbar Lordosis
Postural Curves

Cervical
- Anterior
  - Concave
- Posterior
  - Convex

Thoracic
- Anterior
  - Concave
- Posterior
  - Convex

Lumbar
- Anterior
  - Convex
- Posterior
  - Concave
Posture

Lateral view

Alignment should be through:
- the earlobe
- the acromion process
- Anterior vertebral bodies
- Greater trochanter
- Posterior to the patella
- Ant. to the lat. Malleolus

This woman has severe osteoporosis. How has it affected her posture?
Posture

Anterior view

- Shoulders level
- Sternum centered and in midline
- Hips level
- Knees level
- Feet slight outward toeing
Posture

Posterior view

- Scapula & Shoulders level
- Spinous processes centered and in midline
- PSIS & Hips level
- Knees level, not bowed or knock kneed?
- Ankles straight?
Cervical Spine Assessment

1. Visual Display Terminals (VDT) within the normal cone of vision (0° to 30°)
2. Ears, shoulders, and hips line up vertically
3. Elbows bent at 90° angle while using keyboard (range 70° to 110°) upper arm pointing towards floor
4. Elbows bent at 90° angle while using mouse
5. VDT at proper viewing distance
6. Adequate thigh and leg clearance
7. Knees bent at a 90° angle (range 70° to 110°)
8. Feet supported
9. Hips as far back on chair as possible and bent at 100° to 120°
10. No sharp edges pressing into employee

Figure 1

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Kyphosis

Increased flexion in the thoracic spine, forward head posture in the cervical spine
Osteology of the Cervical Spine & Trunk
They say “you need to have a good head on your shoulders,” but really, you need to have it on your atlas!
Atlas: Caudal aspect

- Anterior tubercle
- Superior articulating facet
- Transverse foramen
- Transverse process
- Vertebral foramen
- Posterior arch
- Posterior tubercle

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Axis: 2\textsuperscript{nd} Cervical Vertebra

Anterior Aspect

- odontoid process (dens)
- superior articulating process
- body

©2003 wkleinelp
Axis: 2\textsuperscript{nd} Cervical Vertebra
Axis: 2nd Cervical Vertebra

- Posterior articular surface
- Body of axis
- Odontoid process
- Superior articulating surface
- Transverse process
- Vertebral foramen
- Arch of axis
- Spinous process (bifid)
Typical Cervical Vertebrae

Superior View.
Parts of a Vertebra

- Body
- Neural Arch
- Vertebral Foramen
- Pedicle
- Lamina
- Transverse Process
- Articular Process
- Spinous Process
Sacrum & Coccyx

Posterior Aspect

Sacro-Iliac joints?
Sacrum & Coccyx

Anterior Aspect
Sacrum & Coccyx

Lateral Aspect

Sacro Iliac Joint?
Intervertebral Discs

Number

- 23

Functions:

- Shock absorption
- Maintain flexibility of the vertebral column
- 25% of the length of the vertebral column
Intervertebral Discs

Annulus Fibrosus

Outer portion

Concentric fibrocartilage rings

Contain the nucleus pulposus
Intervertebral Discs

Nucleus Pulposis

Gelatinous substance

High water content

70-90% at birth

Serving as a hydraulic shock absorber

Less than 70% at 60 years of age

Fig. 5: Intervertebral disc
Joints & Ligaments

Atlanto-occipital joint
Condyles of the occiput & superior articular processes of the atlas
Supports the weight of the head

Atlanto-axial joint
Synovial joint
Odontoid process (dens) of the Axis & and anterior arch of the atlas
Joints & Ligaments

The joints between C2 through S1 are consistent throughout

- Weight-bearing joints
- Synovial joints
- Capsular ligaments
  - Occur anteriorly between vertebral bodies
- Posterior joints bilaterally known as facet joints
Joints & Ligaments

Anterior longitudinal ligament

- Attaches the bodies of the vertebrae on the anterior surface
- Prevents excessive hyperextension
- Thin superiorly and thick inferiorly to fuse the sacrum
- Found in the thoracic and lumbar regions deep to the aorta
Joints & Ligaments

Posterior longitudinal ligament

Attaches to the bodies of the vertebrae on the posterior surfaces inside the vertebral foramen

Prevents excessive flexion

Thick superiorly to help support the skull and thin inferiorly

Contributes to instability and increased disk injury in the lumbar region.
Joints & ligaments

**Supraspinal ligament**
Extends from the 7th cervical vertebra distally to the sacrum posteriorly along the tips of the spinous processes

**Interspinous ligament**
Attaches successive spinous processes

**Nuchal ligament**
Interspinous ligament in the cervical spine
Ligamentum Flavum

Connects adjacent laminae on the anterior surface
We just looked at lots of ligaments. Why do you think that there are so many in the vertebral column?
Scoliosis

Lateral Curvature of the spine

What internal organs become affected if the curvature is severe?

How is the stability of the spine affected?
Pelvic Tilt
The position of the pelvis affects the position of the lumbar spine...

Anterior Pelvic Tilt

Posterior Pelvic Tilt
Sacroiliac Joint

The joint between the sacrum and the ilium where a small amount of motion may take place. If one ilium is rotated forward on the sacrum, back pain may result and the patient may appear to have a functionally longer leg on that side that resolves in supine.
Spondylolisthesis

Anterior displacement of one vertebra over another

L4

L5

Sacrum
Myology of the Vertebral Column
<table>
<thead>
<tr>
<th><strong>Sternocleidomastoid</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Origin</strong></td>
</tr>
<tr>
<td>Sternal head: superior aspect of the manubrium of the sternum</td>
</tr>
<tr>
<td>Clavicular head: medial 1/3 of the clavicle</td>
</tr>
<tr>
<td><strong>Insertion</strong></td>
</tr>
<tr>
<td>Mastoid process of the temporal bone</td>
</tr>
<tr>
<td><strong>Innervation</strong></td>
</tr>
<tr>
<td>Spinal accessory n. (cranial n. XI)</td>
</tr>
<tr>
<td><strong>Action</strong></td>
</tr>
<tr>
<td><strong>Bilateral:</strong> Flexion of the head &amp; neck</td>
</tr>
<tr>
<td><strong>Unilateral:</strong> Contralateral rotation of the head and neck</td>
</tr>
<tr>
<td><strong>Scalenes</strong></td>
</tr>
<tr>
<td>---</td>
</tr>
</tbody>
</table>
| **Origin** | Ant. Scalene: transverse processes of C3-C7  
Middle Scalene: transverse processes of C2-C7  
Posterior Scalene: transverse processes of C5-C7 |
| **Insertion** | Ant. Scalene: 1<sup>st</sup> rib  
Middle Scalene: 1<sup>st</sup> rib  
Posterior Scalene: external surface of the 2<sup>nd</sup> rib |
| **Innervation** | Ventral rami (C3-C7) |
| **Action** | Bilateral: flexion of the neck, assist with inspiration by elevating ribs 1&2  
Unilateral: lateral flexion |
<table>
<thead>
<tr>
<th><strong>Rectus Abdominis</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Origin</strong></td>
</tr>
<tr>
<td><strong>Insertion</strong></td>
</tr>
<tr>
<td><strong>Innervation</strong></td>
</tr>
<tr>
<td><strong>Action</strong></td>
</tr>
<tr>
<td>“tidbits”</td>
</tr>
</tbody>
</table>
### External Oblique

<table>
<thead>
<tr>
<th><strong>Origin</strong></th>
<th>Lateral side of ribs 4-12</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Insertion</strong></td>
<td>Iliac crest and linea alba</td>
</tr>
<tr>
<td><strong>Innervation</strong></td>
<td>Intercostal nerves (T8-T12)</td>
</tr>
<tr>
<td><strong>Action</strong></td>
<td><strong>Bilateral:</strong> Flexion of the trunk, posterior pelvic tilt, increased intra-abdominal and intra-thoracic pressure&lt;br&gt;&lt;br&gt;<strong>Unilateral:</strong> Rotation of the trunk to the contralateral side, lateral flexion of the trunk</td>
</tr>
<tr>
<td><strong>Internal Oblique</strong></td>
<td></td>
</tr>
<tr>
<td>---------------------</td>
<td></td>
</tr>
<tr>
<td><strong>Origin</strong></td>
<td>Iliac crest, inguinal ligament &amp; thoracolumbar fascia</td>
</tr>
<tr>
<td><strong>Insertion</strong></td>
<td>Ribs 9-12, linea alba</td>
</tr>
<tr>
<td><strong>Innervation</strong></td>
<td>Intercostal n. (T8-T12)</td>
</tr>
</tbody>
</table>
| **Action**          | **Bilateral:** flexion of the trunk, posterior pelvic tilt, increases intra-abdominal and intra-thoracic pressure  
**Unilateral:** lateral flexion of the trunk, rotation of the trunk to the ipsilateral side |
**Transverse Abdominis**

<table>
<thead>
<tr>
<th><strong>Origin</strong></th>
<th>Iliac crest, thoracolumbar fascia cartilages of ribs 6-12, &amp; inguinal ligament</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Insertion</strong></td>
<td>Linea alba</td>
</tr>
<tr>
<td><strong>Innervation</strong></td>
<td>Intercostal n. (T7-T12)</td>
</tr>
<tr>
<td><strong>Action</strong></td>
<td>Increases intra-abdominal pressure, increases tension in thoracolumbar fascia</td>
</tr>
<tr>
<td><strong>Iliopsoas</strong></td>
<td></td>
</tr>
<tr>
<td>----------------</td>
<td>------------------</td>
</tr>
</tbody>
</table>
| **Origin**     | Psoas Major: transverse processes of T12-L5  
Iliacus: Iliac fossa |
| **Insertion**  | Lesser trochanter of the femur |
| **Innervation**| Femoral n. |
| **Action**     | Hip flexion, trunk flexion, anterior pelvic tilt |
**Quadratus Lumborum**

<table>
<thead>
<tr>
<th>Origin</th>
<th>Crest of the ilium</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insertion</td>
<td>Transverse processes of L1-L4 &amp; 12\textsuperscript{th} rib</td>
</tr>
<tr>
<td>Innervation</td>
<td>Ventral rami (T12-L3)</td>
</tr>
</tbody>
</table>
| Action   | **Bilateral:** extension of the lumbar region  
            **Unilateral:** lateral flexion of the trunk |
<table>
<thead>
<tr>
<th>Origin</th>
<th>Insertion</th>
<th>Innervation</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
What can you identify?
What can you identify?
Erector Spinae

Large vertically oriented muscles on both sides of the spinous processes *(about one hand’s width laterally)*

- Extend and stabilize the entire vertebral column and craniocervical region
<table>
<thead>
<tr>
<th><strong>Iliocostalis</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Inferior</strong></td>
<td>Lumborum: common tendon</td>
</tr>
<tr>
<td></td>
<td>Thoracis: angle of ribs 6-12</td>
</tr>
<tr>
<td></td>
<td>Cervicis: angle of ribs 3-7</td>
</tr>
<tr>
<td><strong>Superior</strong></td>
<td>Lumborum: angle of ribs 6-12</td>
</tr>
<tr>
<td></td>
<td>Thoracis: angle of ribs 1-6</td>
</tr>
<tr>
<td></td>
<td>Cervicis: transverse processes of C4-C6</td>
</tr>
<tr>
<td><strong>Innervation</strong></td>
<td>Dorsal rami of adjacent spinal n.</td>
</tr>
<tr>
<td><strong>Action</strong></td>
<td><strong>Bilateral</strong>: extension</td>
</tr>
<tr>
<td></td>
<td><strong>Unilateral</strong>: lateral flexion</td>
</tr>
</tbody>
</table>

![Diagram of the spine showing the iliocostalis muscles and their innervation and action.](image)
<table>
<thead>
<tr>
<th>Longissimus</th>
<th></th>
</tr>
</thead>
</table>
| **Inferior** | Thoracis: common tendon  
Cervicis: transverse processes of T1-T4  
Capitis: Transverse processes of T1-T5 & near facet joints C3-C7 |
| **Superior** | Thoracis: transverse processes of T1-T12  
Cervicis: Transverse processes of C2-C6  
Capitis: mastoid process of temporal bone |
| **Innervation** | **Bilateral:** extension  
**Unilateral:** lateral flexion |
| **Action** | Dorsal rami of adjacent spinal n. |
| Spinalis   | Thoracis: common tendon  
|           | Cervicis: ligamentum nuchae and  
|           | spinous processes C7-T1  
|           | Capitis: Blends with semispinalis capitis  
| Superior  | Thoracis: Spinous processes of T1-T6  
|           | Cervicis: Pinous process of C2  
|           | Capitis: Blends with semispinalis capitis  
| Innervation| **Bilateral:** extension  
| Action    | Dorsal rami of adjacent spinal n.  
|
Erector Spinae Muscles
Why ...

1. Were there so many muscles that compressed the abdomen?
2. Are lower back injuries so common?
3. Do so many people have such poor posture if we have so many muscles to help keep our body upright?