


SPINAL MOVEMENT

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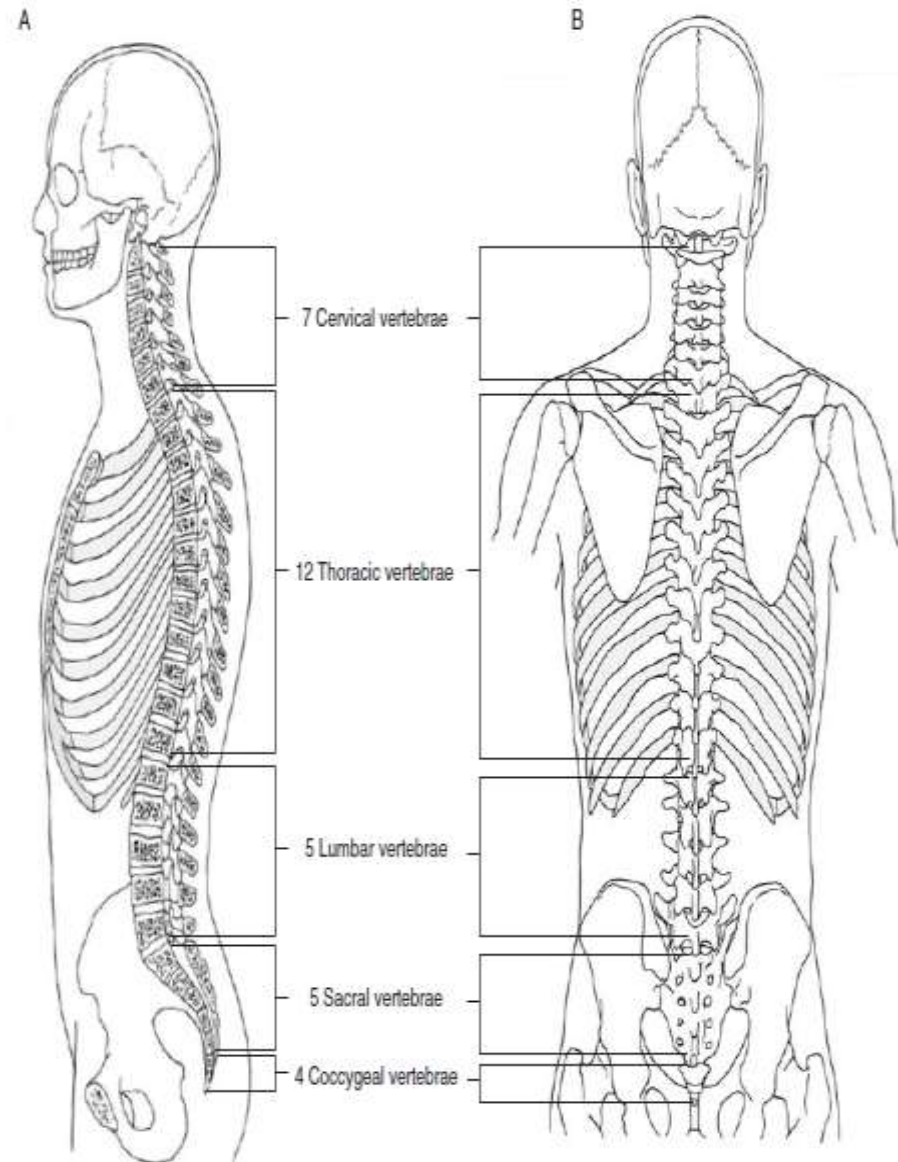
Spinal movement

- The orthopedic manual therapist evaluates and treats orthopedic disorders of the spine with both
- **general** and **specific** movements.
- The more **precisely** a movement is produced, the more specifically the therapist can **identify and treat** a movement dysfunction.
- **General movement:** in the spine involves movement of a set of vertebrae, a vertebral region, or of the entire spine.
- All general movements are under voluntary control (i.e., active movements) and can also be produced passively.

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- **Specific movement:** in the spine is isolated movement of one intervertebral (or mobile) segment.
 - For this reason, specific movement in the spine is also known as **segmental movement.**
 - Isolated movement of an individual mobile segment is not under voluntary control and can only be produced passively.

General Structure and Function of the Vertebral Column

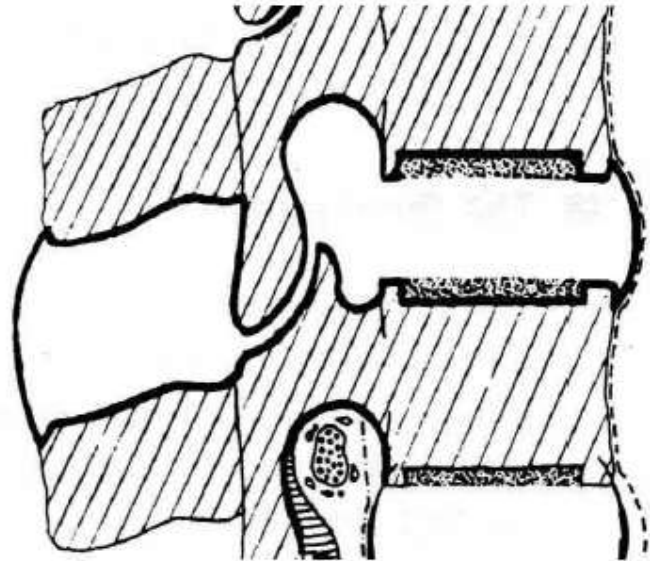
- 33 Vertebrae
- 23 Intervertebral Discs
- Primary Curves
 - Posterior Convexity / Anterior Concavity
 - *Kyphotic Curves*
 1. Thoracic Spine
 2. Sacral Spine
- Secondary Curves
 - Anterior Convexity / Posterior Concavity
 - *Lordotic Curves*
 1. Cervical Spine
 2. Lumbar Spine
- Spinal column with normal curves has **10 fold ability to resist axial** compression in comparison with a straight rod




▲ Figure 4-1 ■ Five distinct regions of the vertebral column.

□ The mobile segment (*segmentum mobile intervertebralis*)

is a three-joint complex composed of the intervertebral disc joint and two facet joints, as well as the muscles, ligaments, and neurovascular structures surrounding, between, and connecting adjacent vertebrae.



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- **The intervertebral disc joint**
 - The intervertebral disc joint (*synchondrosis intervertebralis*) is the synchondrotic articulation between two adjacent vertebral bodies.
 - The disc consists of a nucleus pulposus and an annulus fibrosus. The nucleus has a tendency to expand, which is stopped by the annulus which envelops the nucleus. Both act together.

The Intervertebral Disk

1. Nucleus Pulposus

- 70 to 90% of water
- PG's 65% of dry weight
- Collagen 15 to 20% of dry weight
- Remaining are elastin, protein, proteolytic enzymes, chondrocytes, and other types of collagen

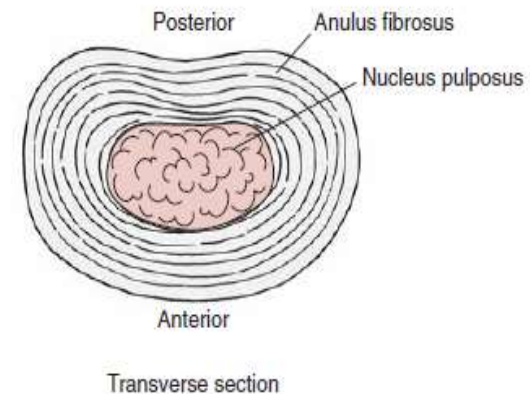
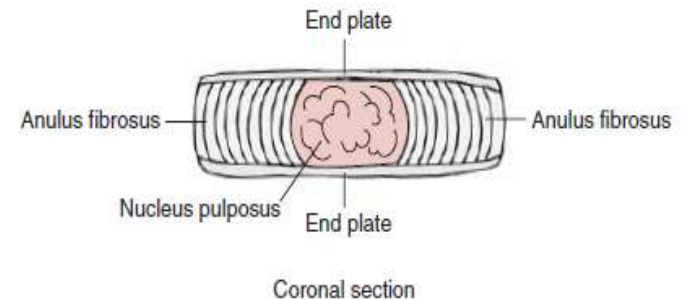
1. Type II collagen predominates because of its ability to resist compressive loads

- 2. Its like water balloon

2. Annulus Fibrosus

- 60 to 70% of water
- Collagen 50 to 60% of dry weight
- PG's 20% of dry weight
- 10 % are elastin and remaining are fibroblasts and chondrocytes

- Type I collagen is in greater proportion because of its ability to resist greater tensile forces



The Intervertebral Disk

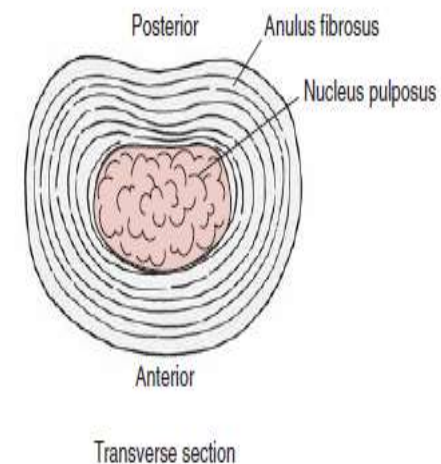
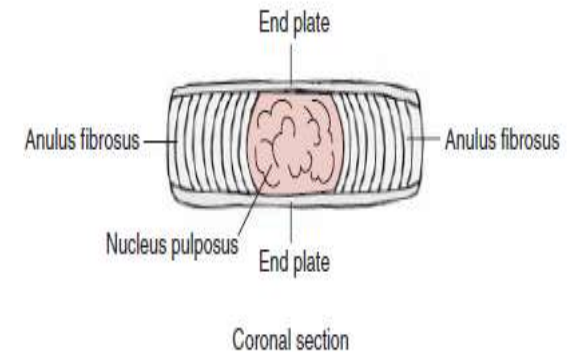
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3. Vertebral End Plate

- Layer of 0.6 to 1 mm thick covering both upper and lower part of disk
- VEP attached with disc with sharpey fibers
- Strongly attached with annulus fibrosus and weakly attached with the vertebral body

➤ Innervation and Nutrition

- Outer $1/3^{\text{rd}}$ to $1/2$ is innervated
- Innervation from vertebral and sinuvertebral nerves
- Blood supply from dense capillary plexus in the base of the end plate cartilage
- The remainder of the disk receive its nutrition via diffusion



- The main functions of the disc are:
- » Static - to transmit loads from one vertebra to the next and to distribute loads evenly to the end-plate.
- » Movement - to maintain sufficient distance between two vertebrae to allow movement between them.
- » Stabilization - to connect two vertebrae and to restrict excessive intervertebral movement.

Articulations

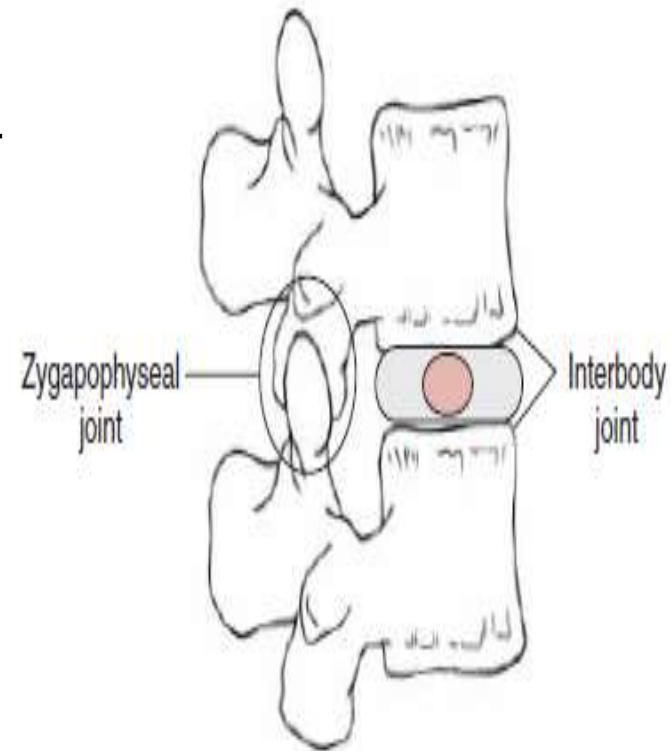
- Two types of joints
 1. Cartilaginous joints of symphysis type between the vertebral bodies
 2. Synovial joints between the zygapophyseal facets (zygapophyseal or facet joint)
- The joint between the vertebral column with ribs, with the skull, and with the pelvis at SI joint are the synovial joints

1. Facet/zygapophyseal joints

- Joints between the superior articular facet of the lower vertebra and inferior articular facet of the superior vertebra
- Appreciation of opening and closing of the joint space in different movements

2. Interbody joints

- Joints between the IVD and the body of the vertebra
- Available movements (6 degrees of freedom) are
 - Gliding : Anterior to Posterior, Medial to Lateral, and Torsion
 - Rotation: anterior to posterior and in lateral directions
 - Distraction and Compression:



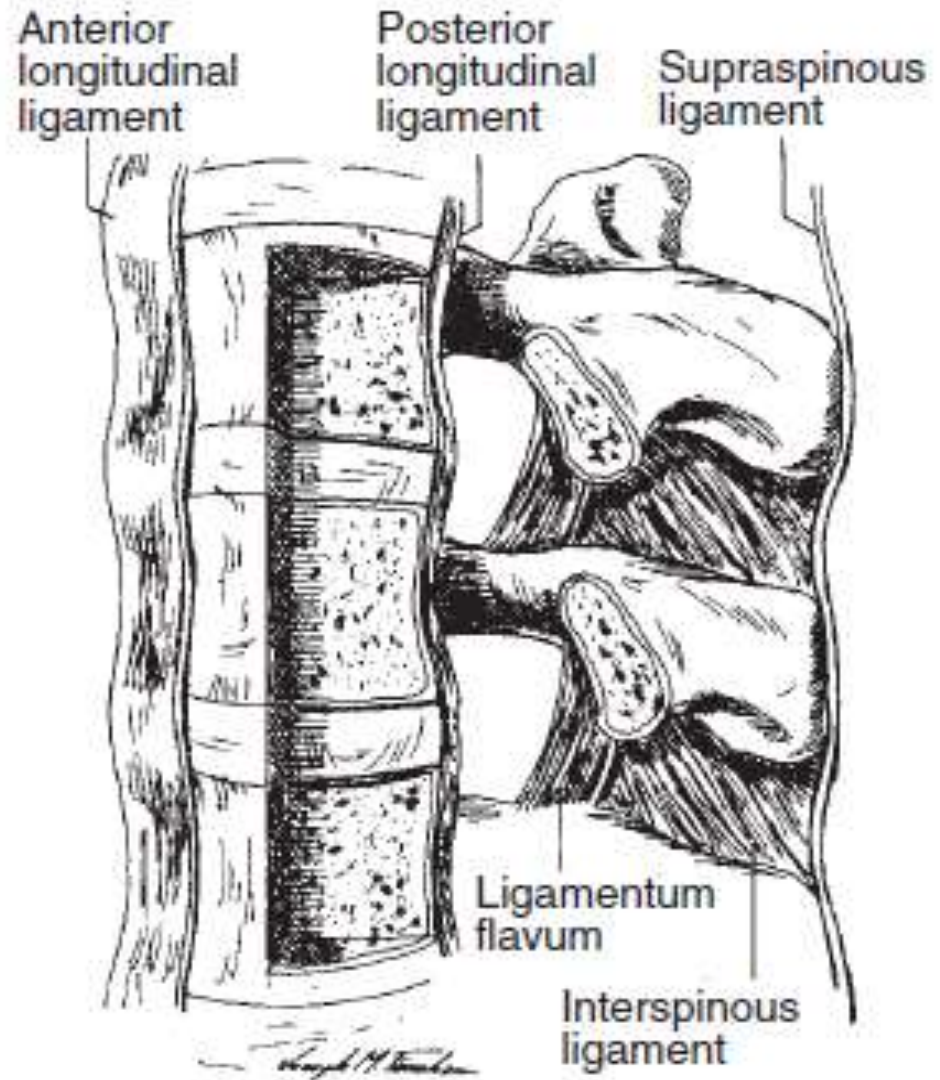
The facet joint

- The facet (zygapophyseal) joints (*articularis interarcualia*), also called the synovial intervertebral joints, are true synovial joints.

The spacial orientation of a facet's articular surface influences the direction of movement available in each mobile segment and limits the range of certain spinal movements . *In the cervical and thoracic* regions, and also in the lower lumbar region, the facets also provide some load-bearing support. It is crucial for the manual therapist to know the orientation of each facet joint surface in order to safely and effectively direct passive spinal movement.

Ligaments and Joint Capsules

- Six main ligaments
 1. Anterior Longitudinal Ligaments
 2. Posterior Longitudinal Ligaments
 3. Ligamentum Flavum
 4. Interspinous Ligaments
 5. Supraspinous Ligaments
 6. Intertransverse Ligaments



Factors on which spinal mobility depends upon ???

- **The Disc to vertebral Height ratio:**
 - 1:3 Cervical, 1:6 Thoracic, 1:3 Lumbar spine
- **The Vertebra's Width to Height ratio:**
 - C Vertebra has relatively small anteroposterior and transverse diameters in relation to the body height
- **Orientation of Articular processes:**
 - Superior articular facet of C Spine faces Posteriorly and slightly laterally , T- Spine faces Poserioly, Lumbar spine faces medially
- **The extent of Mechanical Displacement:**

Shape of Superior Articular facets (Maignee)

Spinal range of movement

- The amount of motion possible for a mobile segment is limited either by the
- **facets or by the intervertebral disc joint,** depending on the movement direction.
- The higher the disc is in relationship to its own diameter, the greater the mobility of the intervertebral(mobile) segment.
- **Spinal curvatures** will vary depending on the shape of an individual's discs and vertebral bodies.



It also depends upon.

- Age
- Health of surrounding tissues
- Physical conditioning
- Hereditary factors
- Functional anatomy

- In flexion- ends (C&L) flatten e increased khyphosis.
- In extension spine acts like a rod e dorsally curved endings.

