Spinal Movements continued….

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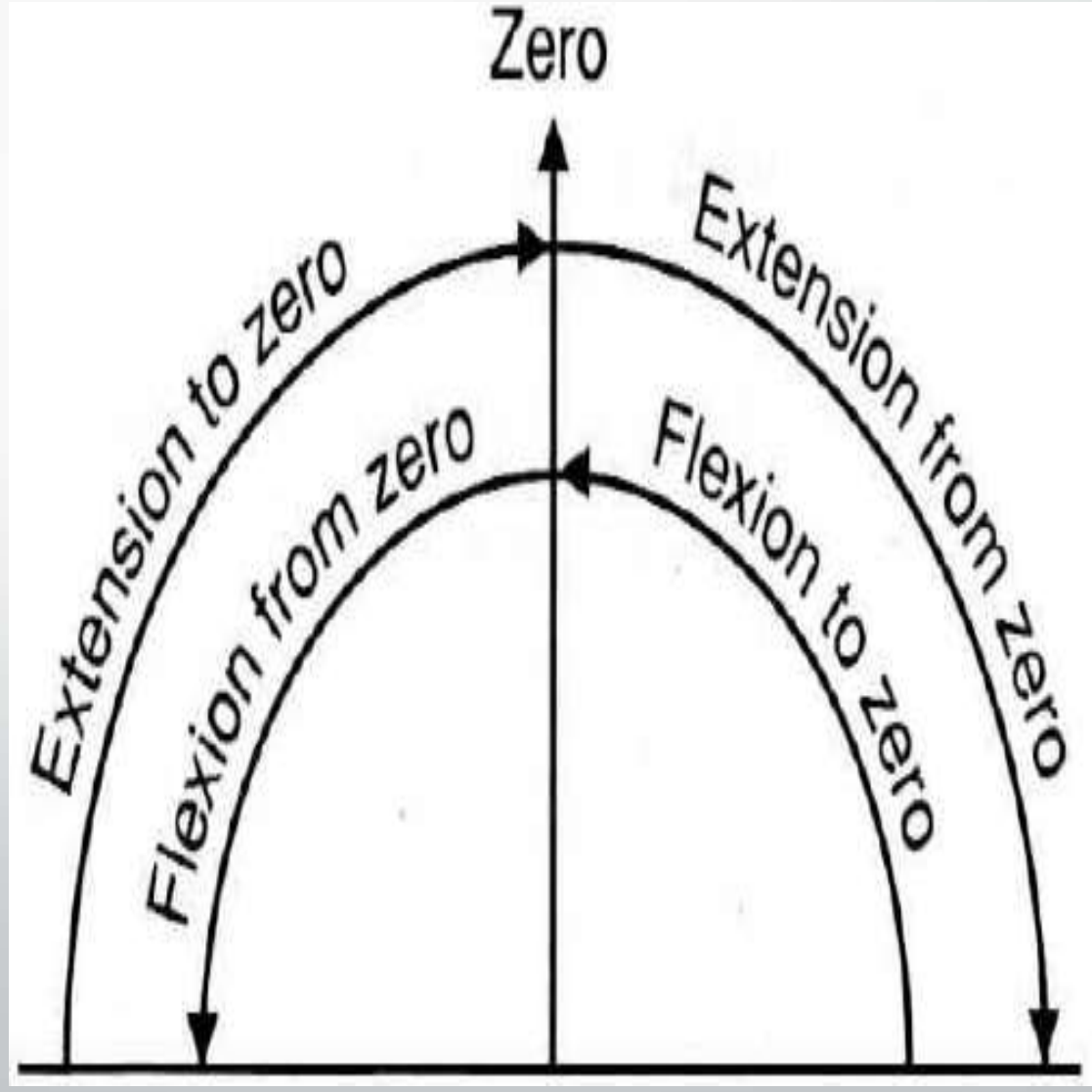
Zero position

All joint range of motion measurements are taken from the zero starting position, if possible.

The range of motion is measured with a goniometer on both sides of zero.

For example, a movement of thirty degrees flexion and ten degrees extension is written:

flexion/extension 30-0-10.



Close-packed position

- The close-packed position is characterized by the following criteria:
- » The joint capsule and ligaments are tight or maximally tensed.
- » There is maximal contact between the concave and convex articular surfaces.
- For example, the shoulder is close-packed

  when it is positioned in maximal extension and external rotation.
- » Articular surface gliding is maximally reduced and only slight separation with traction forces is possible.
- Joint play testing and mobilization is difficult to perform at or near the close-packed position.

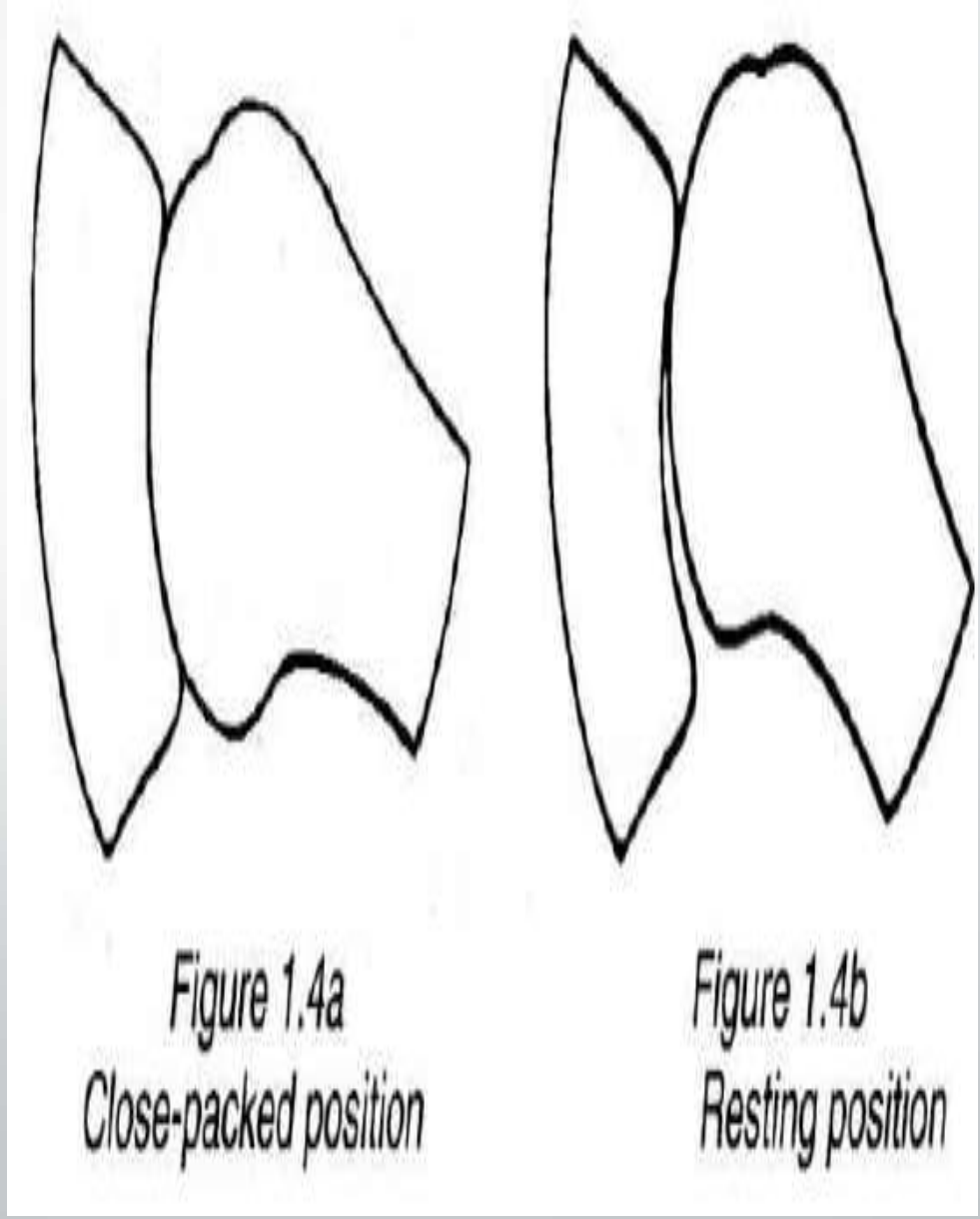


Figure 1.4a
Close-packed position

Figure 1.4b
Resting position

Joint locking

- Spinal mobilization techniques are most effective and safe when movement is focused ("localized") within the spinal segments to be treated while adjacent segments remain stable ("locked" in a close-packed position) and restrained from following the movement.
- Spinal locking maneuvers are usually used either **cranial or caudal** to the treated segment.

- The manual therapist locks a spinal segment by placing it in a movement pattern that constrains its movement.
- ***Noncoupled*** *movement patterns provide the most effective spinal locking* (stabilization).
- If a neighboring joint segment is hypermobile or symptomatic with movement into the mobilizing direction (e.g., facet syndromes) it may be necessary to ***manually stabilize*** these segments opposite to the intended mobilization force.

Bone and joint movement

- Bone movements produce associated joint movements.
- The relationship between a bone movement ***(osteokinematics)*** and its associated joint movements ***(arthrokinematics)*** forms the basis for many orthopedic manual therapy (OMT) evaluation and treatment techniques.

- Two types of bone movements are important in our OMT system:
- ***Rotations***: *curved (angular) movement around an axis*
- ***Translations:*** *linear (straight-lined) movement parallel* to *an axis in one plane.*
- Rotations of bone produce the joint movement of roll-gliding.
- Translations of bone result in the linear joint play movements of traction, compression, and gliding.

Bone movements	*Corresponding joint movements*
Rotatoric (curved) movement	**Roll-gliding**
- Standard (anatomical, uniaxial)	
- Combined (functional, multiaxial)	
Translatoric (linear) movement	**Translatoric joint play**
- Longitudinal bone separation	- Traction
- Longitudinal bone approximation	- Compression
- Transverse (parallel) bone movement	- Gliding

- **Standard bone movements**
- Standard bone movements are bone rotations occurring around one axis (uniaxial) and in one plane.
- Standard movement is called "anatomical" movement when the movement axis and the movement plane are in anatomical (or cardinal) planes.

- **Anatomical bone movements beginning at the zero position**

  are useful for describing and measuring test movements.

  - They provide a standardized method for **communicating examination findings** that can be reproduced by other health care professionals.

- Anatomical movements of the vertebral bones in the three cardinal planes are described below.

Sagittal plane movements around a frontal axis

- » **Flexion (forward or ventral flexion):**
- The spinous process moves cranially.
- » **Extension (backward or dorsal flexion):**
- The spinous process moves caudally.

Frontal plane movements around a sagittal axis:

- » **Sidebending (lateral flexion)**
- With sidebending to the right, the right transverse process moves caudally and the left transverse process moves cranially.
- The opposite takes place with side bending to the left.

Transverse plane movements around a vertical (longitudinal) axis

- » **Rotation:**
- Right rotation is rotation in the clockwise direction viewed from the cranial direction; the spinous process moves to the left.
- The opposite takes place with rotation to the left.

Combined bone movements

- Bone movement that occurs simultaneously around more than one axis (multiaxial) and in more than one plane is called combined, or functional, movement.
- For example, the simultaneous flexion (frontal axis, sagittal plane) with sidebending (sagittal axis, frontal plane) and rotation (vertical axis, transverse plane) is a combined movement.

These movements do not occur purely in cardinal planes and around defined axes, but rather in oblique or diagonal directions.

Classification of Spinal Combined Movements

- We classify spinal combined movements as
- coupled or noncoupled
- according to the degree and nature of movement ease possible when flexion or extension, rotation, and sidebending are combined in various ways.
- ***Coupled movements:***
- have the greatest ease (greatest range, least resistance to movement, softest end-feel).
- ***Noncoupled movements:***
- *have less ease* (less range, more resistance to movement, and a harder end-feel).

- Various combined movement patterns are used in OMT to specifically enhance or limit movement.
- For example,
- using coupled movements for combined spinal joint and soft tissue techniques allows for greater tissue excursion.
- Using non-coupled movements for locking techniques will restrain movement in adjacent vertebral segments.

Coupled movements

- Movement combinations that result in the most ease of movement (the greatest range of movement, least resistance and softest end-feel) are classified as coupled movements.
- coupled movement is easier to perform and is more automatic (non-voluntary) in behavior.
- Depending on whether the spine is in flexion or extension, side bending must be associated with a particular rotation to produce maximum movement ease.

- The range of a coupled movement is greatest when all components of the movement pattern occur simultaneously.
- If one component of movement occurs before the other movement components, the available range of movement in the remaining component directions is reduced.

Noncoupled movements

- Combined movements are classified as
- non coupled movements when they produce less movement ease (more restricted range of movement and a harder end-feel) than coupled movements and the relationship between rotation and sidebending is reversed.

Combined movement patterns in the spine

- • Upper cervical spine (above C2):
- Coupling between sidebending and rotation usually occurs to opposite sides, regardless whether those vertebrae are in flexion or extension.
- Sidebending and rotation to the same side will usually produce a noncoupled movement.
- • Cervical spine (below C2):
- Coupling between sidebending and rotation usually occurs to the same side, regardless whether those vertebrae are in flexion or extension.
- Sidebending and rotation to opposite sides will usually produce a noncoupled movement.

In the thoracic and lumbar spine (from about T4 to L5),

- The positions of flexion and extension alter the coupled relationship between side bending and rotation .
- • Thoracic spine in the resting position and in flexion (kyphosis):
- Coupling between sidebending and rotation usually occurs to the same side.
- Sidebending and rotation to opposite sides will usually produce a noncoupled movement.
- Thoracic spine in marked extension (flattened or lordosis):
- Coupling between sidebending and rotation usually occurs to opposite sides. Sidebending and rotation to the same side will usually produce a non-coupled movement.

Lumbar spine

- • Lumbar spine in the resting position and in extension (lordosis):
- Sidebending usually couples with rotation to opposite sides.
- Sidebending and rotation to the same side will usually produce a non-coupled movement.
- Lumbar spine in marked flexion (kyphosis):
- Sidebending usually couples with rotation to the same side.
- Sidebending and rotation to opposite sides will usually produce a noncoupled movement.