

A lateral X-ray of the spine, showing the vertebrae and intervertebral discs. The image is in grayscale and has a blue tint. The spine is curved, and the vertebrae are clearly visible. The intervertebral discs are the darker spaces between the lighter-colored vertebrae. The title 'The Spine' is overlaid on the lower right portion of the image.

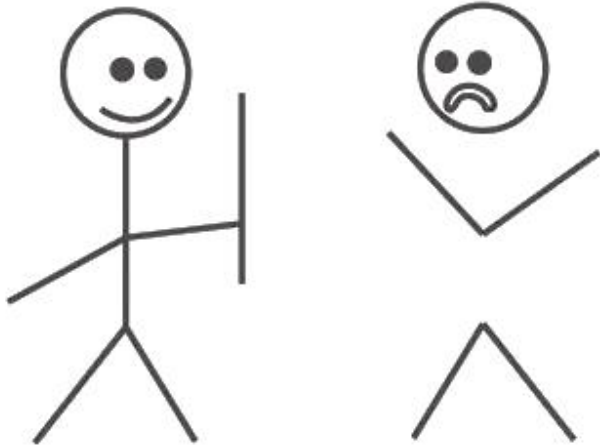
# The Spine

J. Brent Feland, MSPT, PhD  
CSCCa National Conference, Orlando,  
2017

# Why Understand the Back?

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I've got your back!

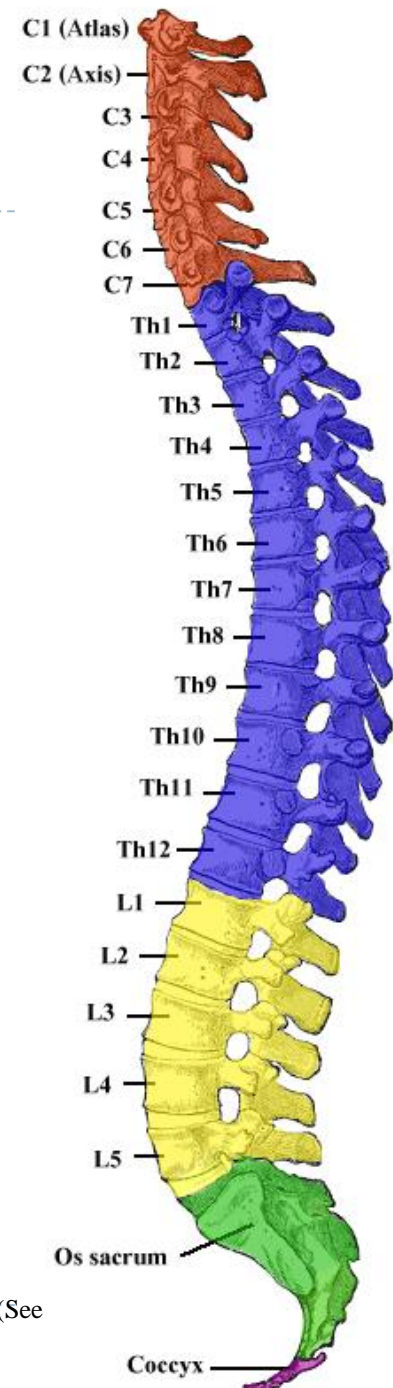


- ▶ Do you really have your athlete's back?
- ▶ Do you just ignore complaints of pain?
- ▶ Do you know how to accommodate back pain?
- ▶ Understanding the mechanics of the spine can hopefully change how you address back issues in training.



# Spinal Review – The Vertebrae

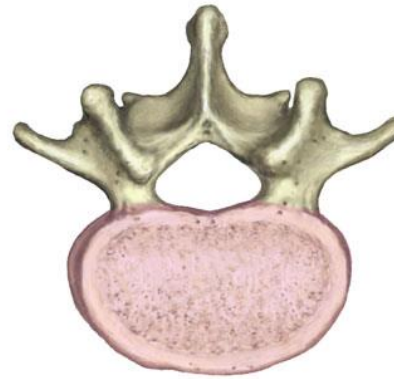
- ▶ Neck
  - ▶ 7 Cervical
- ▶ Mid-back
  - ▶ 12 Thoracic
- ▶ Low back
  - ▶ 5 Lumbar
  - ▶ 1 sacrum (made up of 4-5 fused segments)
  - ▶ 1 coccyx



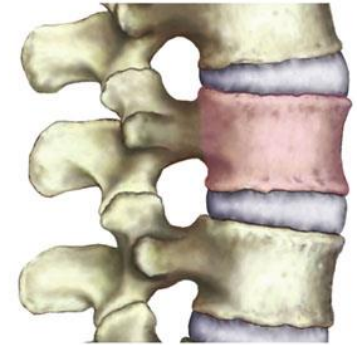
▶ By Henry Vandyke Carter - Vertebral column image.- From: Henry Gray (1918) Anatomy of the Human Body (See "Book" section below)- Altered by User:Uwe Gille, Public Domain, <https://commons.wikimedia.org/w/index.php?curid=1282158>

# Vertebral Body

- Functions of the vertebral body:
  - Transmits body weight
  - Provides flexible structure upon which muscles can act
  - Provides attachment
  - Limits ROM
  - Absorbs shock (this is the actual “cushion”, not the disc!)

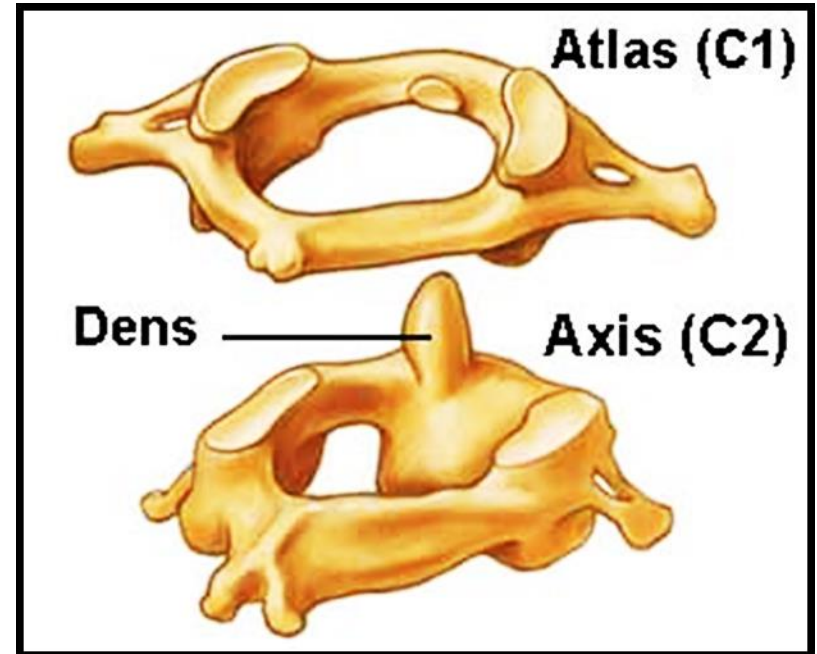


Vertebral Body



# Cervical Vertebrae

- ▶ C1 = Atlas. It does not have a body or disc.
- ▶ C2 = Dens to articulate with the axis. 50% of your neck rotation comes from the atlantoaxial joint.
- ▶ C3-C7 have a more normal appearance.
- ▶ All have a transverse foramen for the vertebral artery which enters the skull to supply the brain.
- ▶ Bifid spinous process for the ligamentum nuchae and greater amount of neck muscles

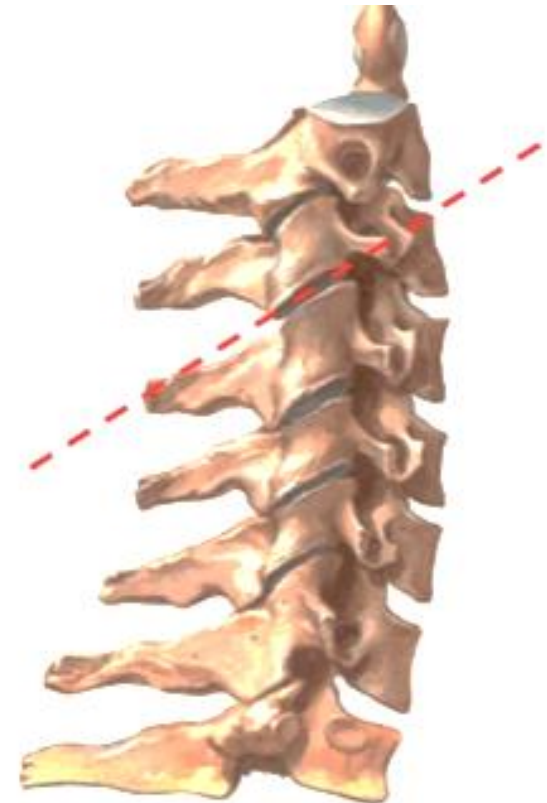
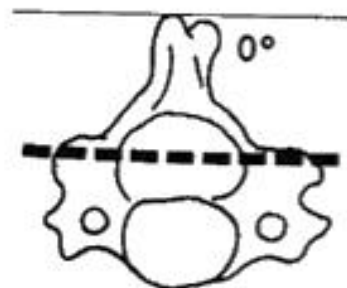
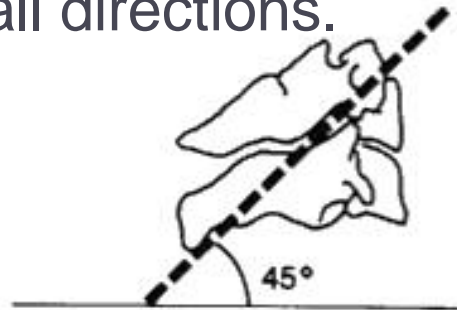


# Movement in the Cervical Area

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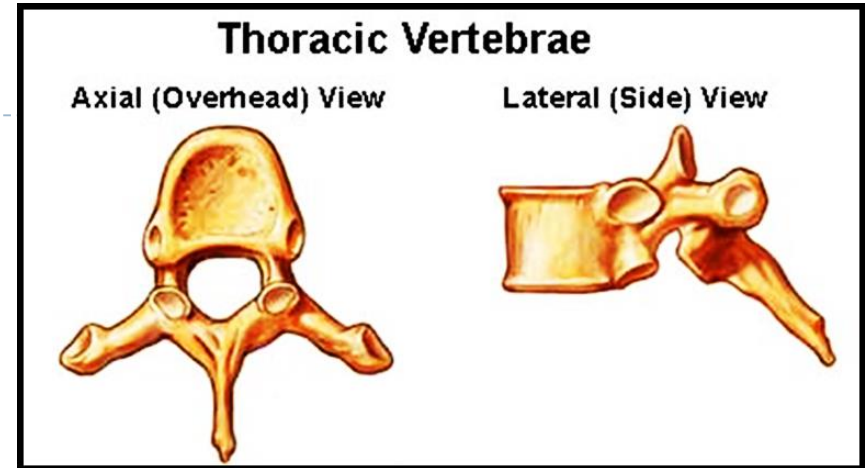
## ▶ Cervical

- ▶ Articular processes in an oblique plane which allow the cervical spine to have more combined movement than Thoracic or Lumbar.
- ▶ Movement in all directions.



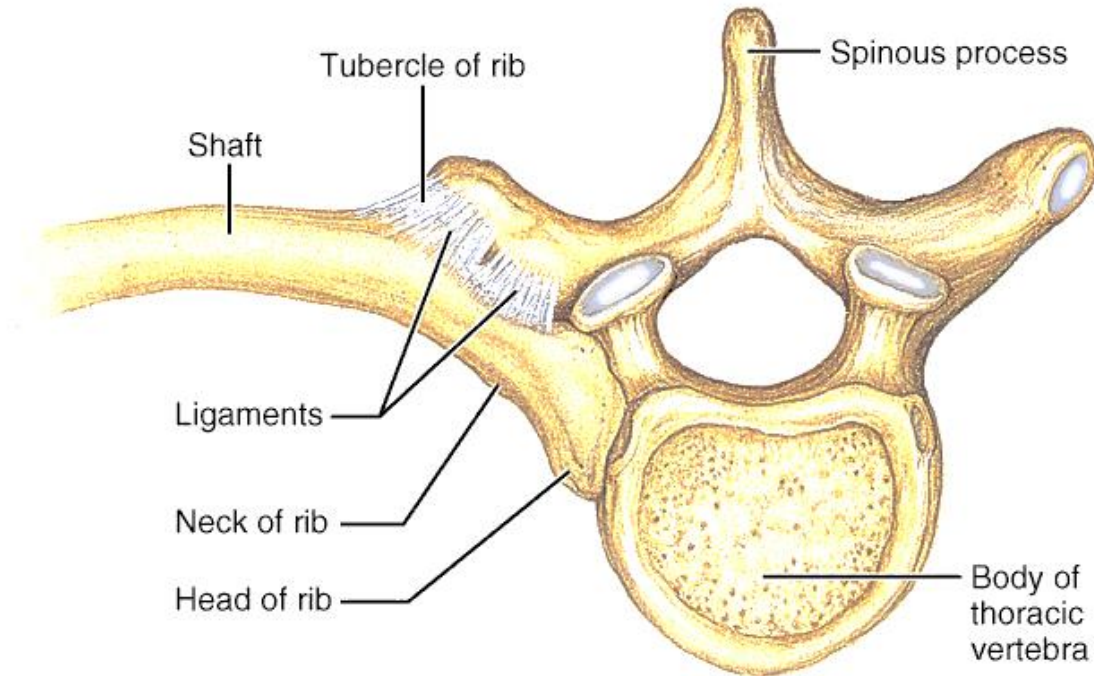
# Thoracic Vertebrae

- ▶ All 12 thoracic vertebrae have a notch in their transverse processes and a facet on their bodies for Rib attachment.



While thoracic disc problems are not very common, rib dysfunctions are a common cause of thoracic based pain, but

- ▶ usually temporary



(b)

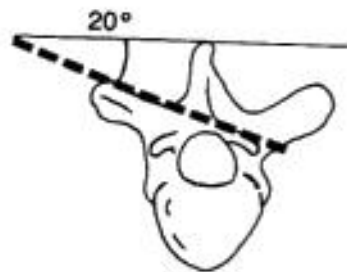
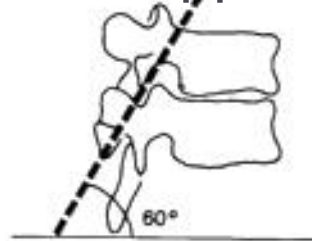
# Movement in the Thoracic Area

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## ▶ Thoracic

- ▶ Facets in frontal plane in Upper thoracic
- ▶ Move toward sagittal plane in lower thoracic
- ▶ More lateral bending and rotation. Extension limited in upper

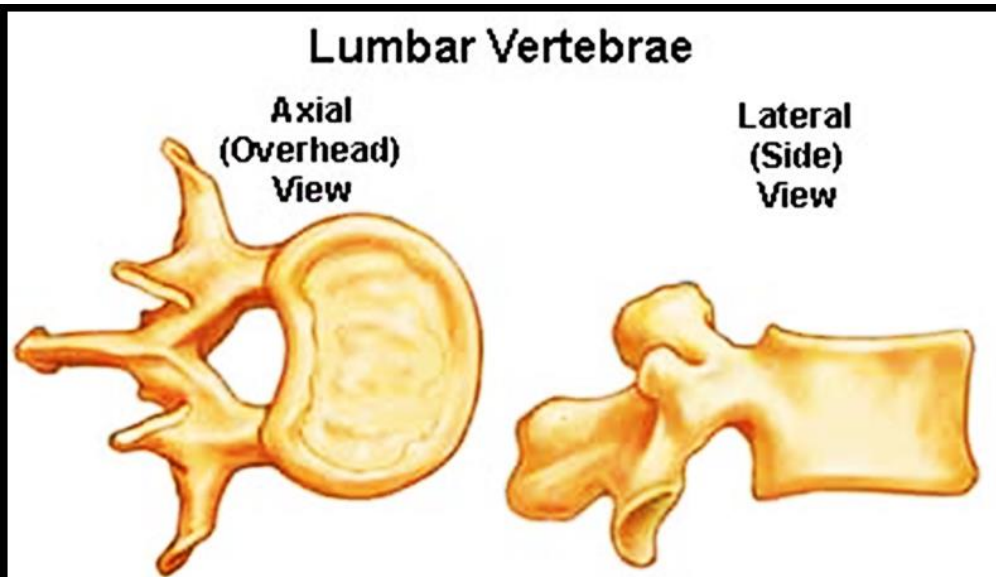
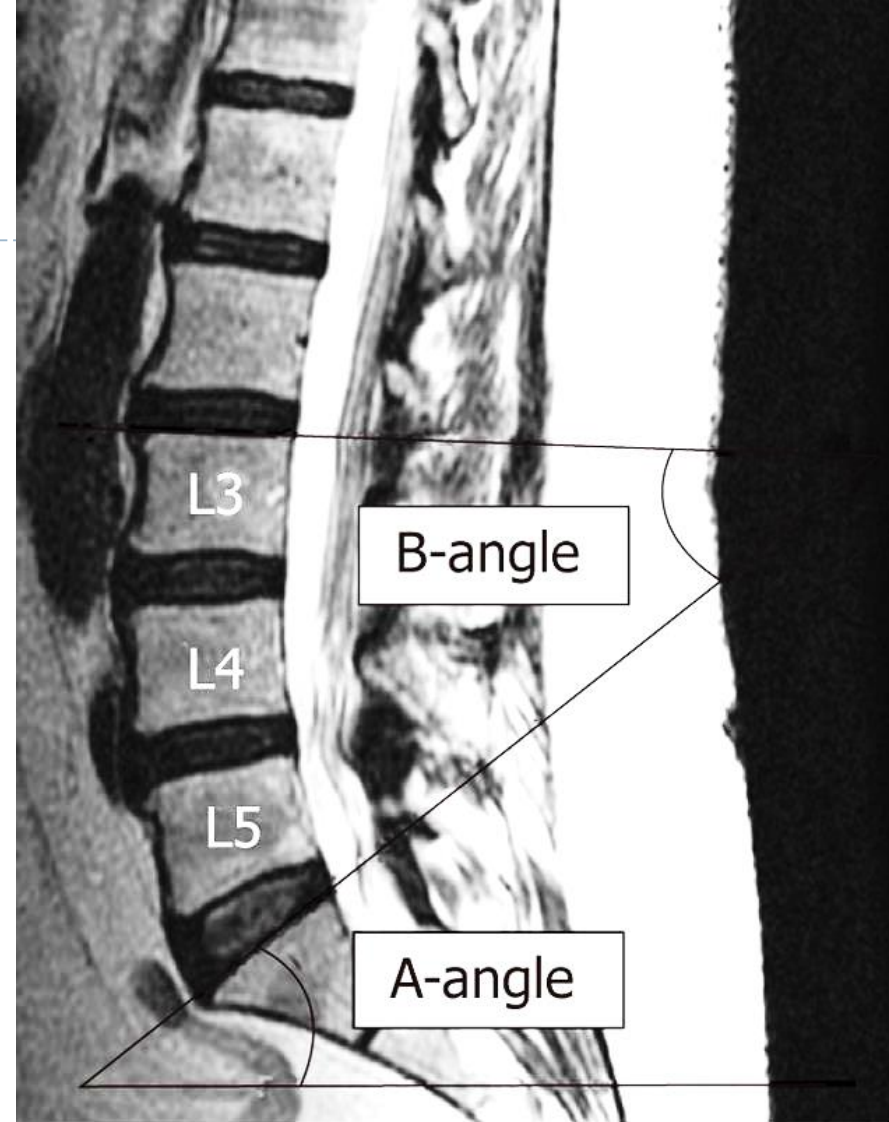
You can feel this since it does not want to extend in this area





# Lumbar Vertebrae

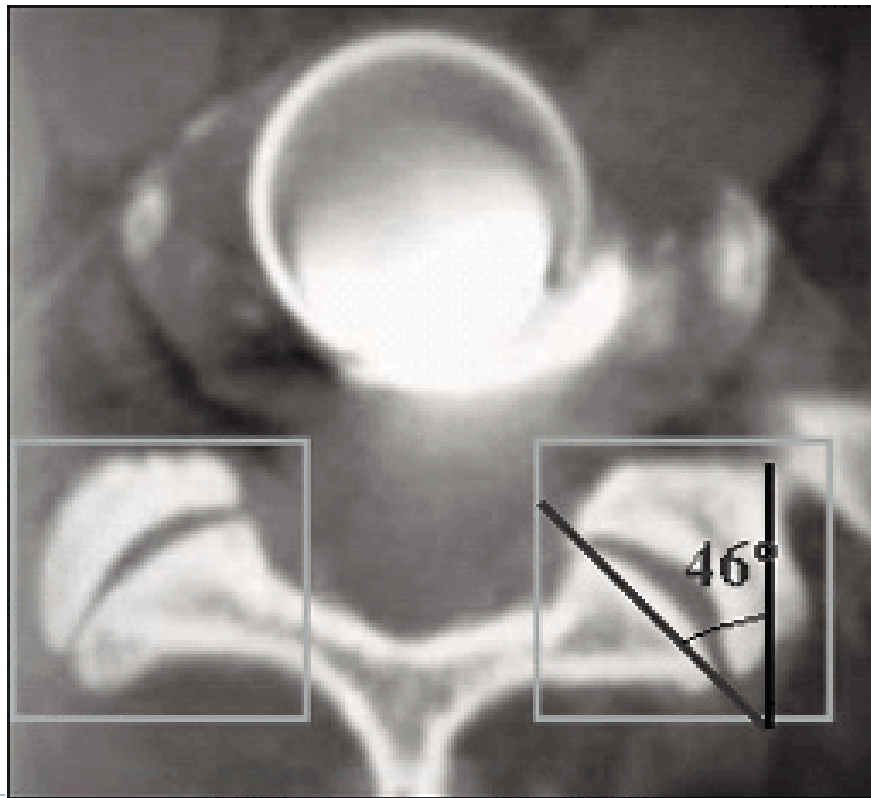
- ▶ Thicker and larger to handle compressive loads and strong muscle forces.
- ▶ Lordotic curve places shear force on the discs at the lower levels.



# Facet joints in the Lumbar Area

Medscape®

www.medscape.com



| Level | Angle      |
|-------|------------|
| L1-L2 | 25 (15-47) |
| L2-L3 | 28 (17-51) |
| L3-L4 | 37 (15-57) |
| L4-L5 | 48 (13-70) |
| L5-S1 | 53 (36-70) |

# Back Pain – What Kind?

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- ▶ There are a myriad of potential causes of back pain depending on what level the pain is occurring. This makes determining the actual cause quite difficult.
  
  - ▶ For this presentation I am going to focus on the 3 specific areas that I feel are the most common issues I see.
    1. Rib dysfunctions in the thoracic spine
    2. Sacroiliac joint dysfunctions (SI joint)
    3. Generalized low back pain
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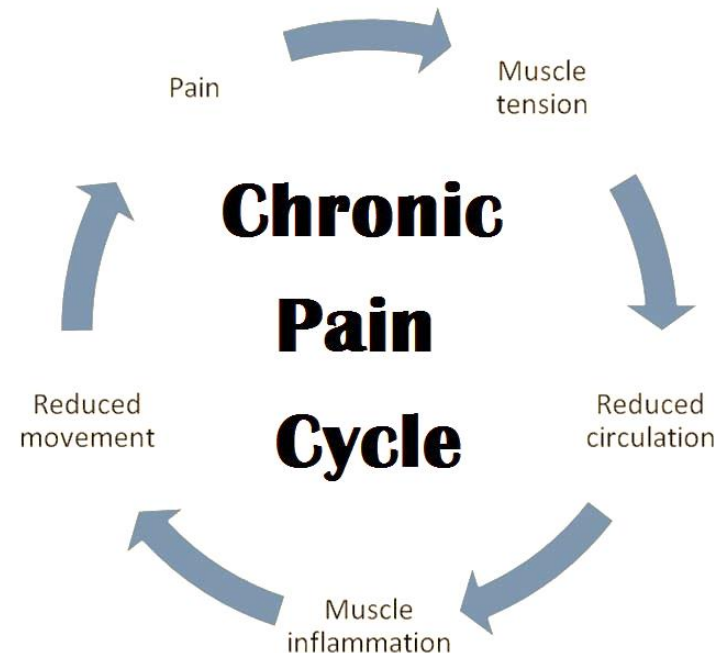


# Acute, Chronic or In-Between?

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- ▶ Acute back pain can last 3-4 weeks
- ▶ Subacute back pain can last up to 12 weeks
- ▶ Chronic back pain is longer than 3 months

Keep in mind that chronic pain also has a negative cycle that includes a significant psychological component where, anxiety, depression, poor sleep can also increase pain perception and hamper physical performance



# Potentially Serious?

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- ▶ A common Question I get is when should I actually go see the Dr?
- ▶ Pain and it's characteristics vary greatly, but I feel it is important for you to understand the difference between what is called:
  - ▶ Mechanical Pain – also known as positional pain
  - ▶ Non Mechanical Pain – also known as non-positional pain



# Mechanical Back Pain

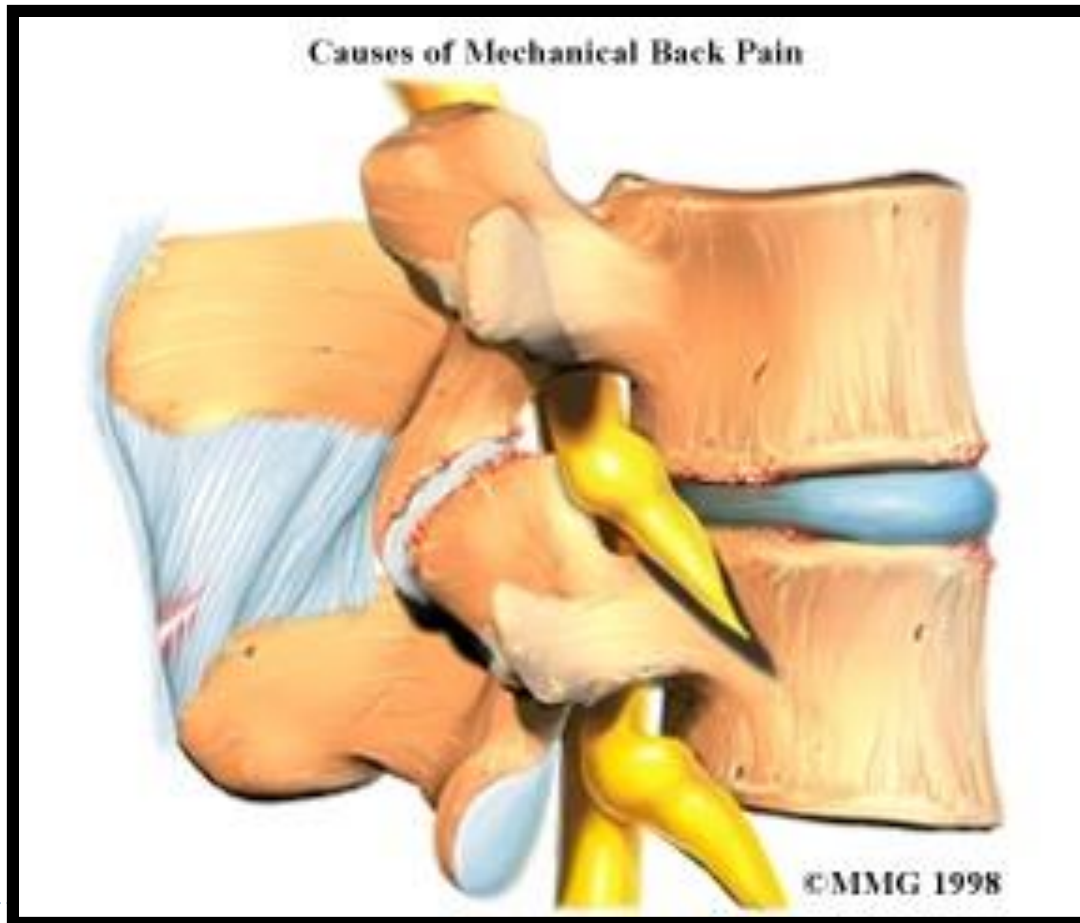
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- ▶ Often Acute or sudden onset
- ▶ Damage or irritation to
  - ▶ Ligament
  - ▶ Muscle
  - ▶ Connective tissue
  - ▶ Facet joint (or bone)
  - ▶ Possible early Annular damage to the disc
- ▶ Usually gets worse over the course of the day
- ▶ Not directly nerve related, but can radiate down to the buttocks or hips
- ▶ Pain is usually cyclic
- ▶ Pain is aggravated by a specific direction or movement (Positional)
- ▶ Pain is relieved by lying down, or a specific movement or position



# Many Possible Causes of Mechanical Back Pain

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Irritated facet capsule, arthritic or degenerative changes as well as osteophytes on surrounding bone.

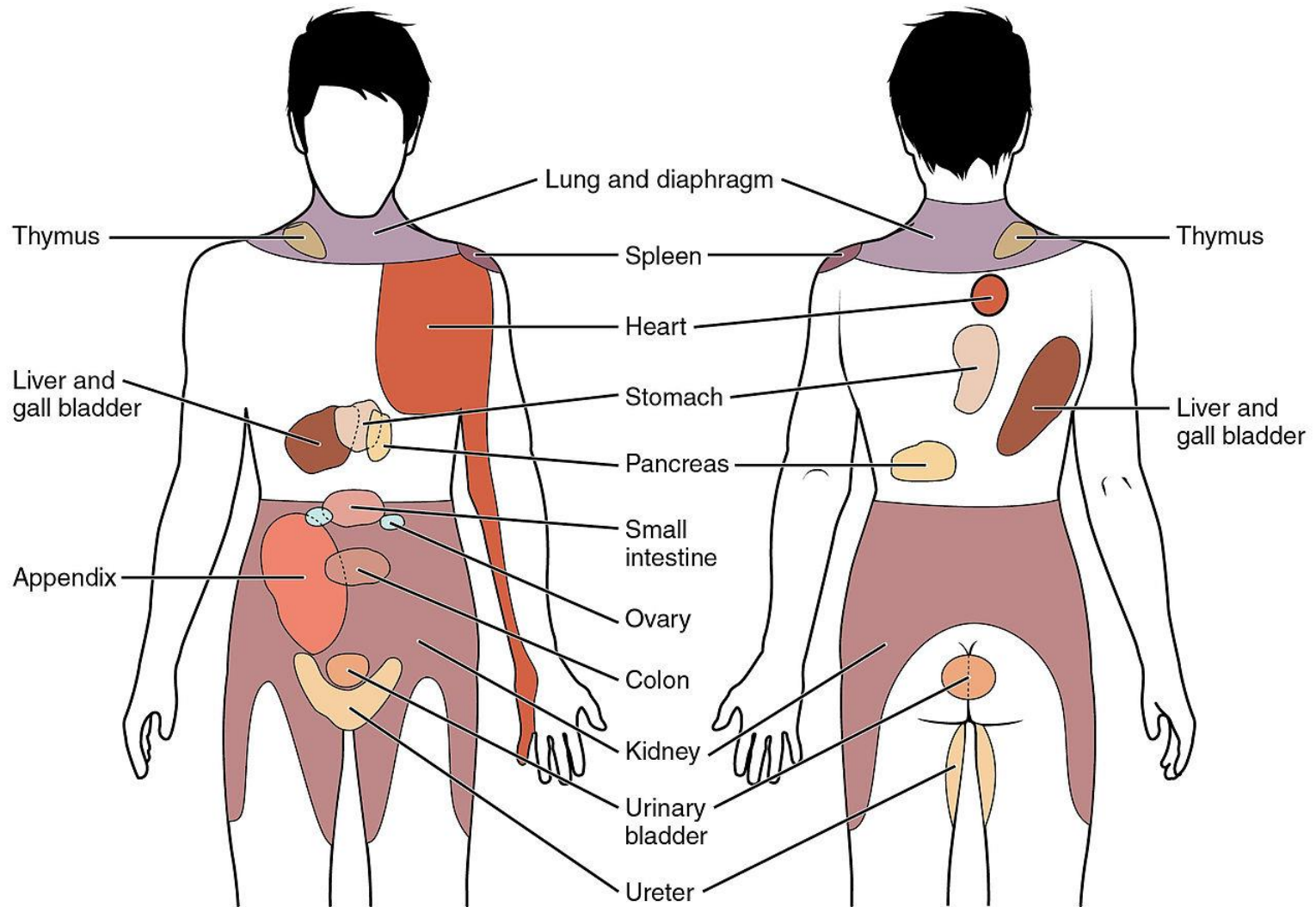
# Non-Mechanical Back Pain or Neurologic Pain

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- ▶ Often progressive and insidious onset, but can be acute.
- ▶ Possible irritation to
  - ▶ Intervertebral disc
  - ▶ Nerve root
  - ▶ Internal organ
- ▶ Random pain patterns tend to worsen over time
- ▶ Sensory changes in the saddle area or problems with micturition should be checked asap.
- ▶ Nerve related can radiate down to the lower leg and foot
- ▶ Pain usually exacerbated by sitting and better when standing
- ▶ Internal organ problem (i.e. kidney stone) creates vague achy deep pain that does not appear to have any position that alleviates it. (non positional pain)



# Referred Pain Patterns



# When do I see a Doc?

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- ▶ Athletes should be reporting any and all back pain
- ▶ Serious issues for referring the athlete (or yourself) include:
  - ▶ Radiating pain or numbness (especially if going below the knee)
  - ▶ Non-positional pain (may indicate internal organ referred pain)
  - ▶ Pain or numbness in the saddle area
  - ▶ Noticeable and explainable changes in micturition



# What is a Rib Dysfunction?

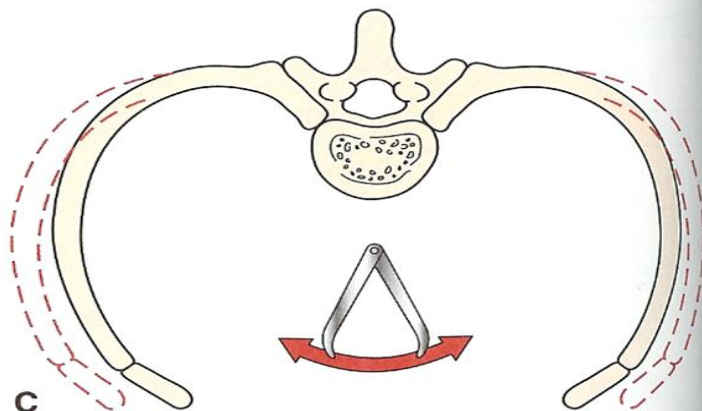
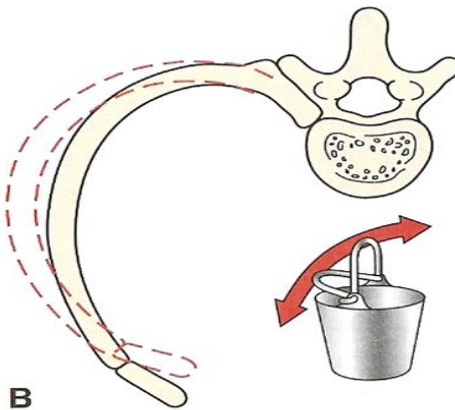
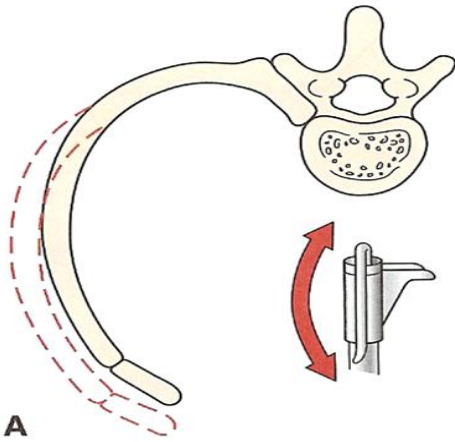
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- ▶ Usually an acute onset of mechanical pain
- ▶ More commonly found between the scapulae
- ▶ Pain is usually localized in the back, but the right kind of rib dysfunction can radiate pain around the rib toward the sternum
- ▶ Rib dysfunctions can exist without “back pain” and be evident in respiratory restrictions.



# Rib Movement in the Thoracic Spine

- ▶ A: Pump handle, ribs elevate, expand rib cage in anterior direction (1 – 6)
- ▶ B: Bucket handle, lateral-superior direction (7 – 10)
- ▶ C: Caliper, lateral direction (transverse plane), opening up anteriorly (8 – 12)



# Rib Motions

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- ▶ **Primary Motions: Inhalation and Exhalation**
  - ▶ Pump handle motion (major movement in upper 6 ribs)
  - ▶ Bucket handle motion (major movement in below rib 6)
- ▶ **Caliper motion of Rib 11 and 12**
- ▶ **Torsional movement**
  - ▶ When T5 rotates to the right in relation to T6, the posterior aspect of the right 6<sup>th</sup> rib turns externally and the posterior aspect of the left 6<sup>th</sup> rib turns internally.

# Acute Rib Dysfunctions – back pain

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- ▶ Acute (structural) rib dysfunctions include:
  - ▶ Anterior subluxation
  - ▶ Posterior subluxation
  - ▶ Anteroposterior compression
  - ▶ Lateral compression
- ▶ The compression dysfunctions can commonly exhibit chest wall pain (intercostal neuralgia type). Common in motor vehicle and sports injuries. In many instances their presentation suggests a rib fracture which is not supported with imaging.
- ▶ Subluxations tend to cause nagging pain and tautness of the iliocostalis muscle around the rib

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▶ angle.

Greenman's Principles of Manual Medicine, 4<sup>th</sup> ed., pg 257.

# Final Rib Thoughts

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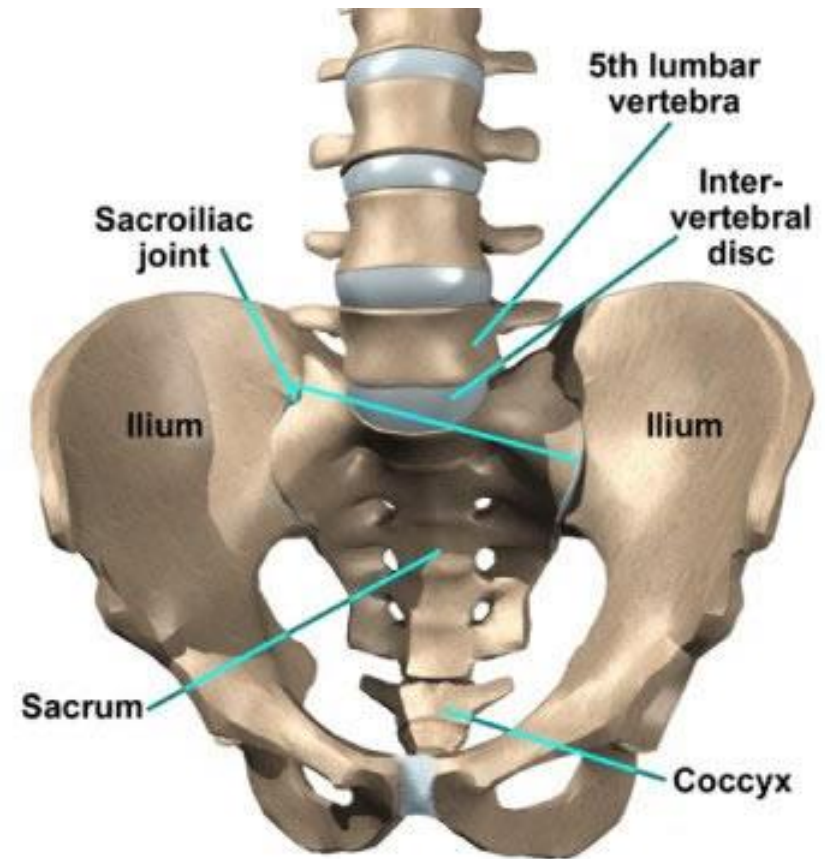
- ▶ 1<sup>st</sup> rib issues can cause pretty significant lower neck pain.
- ▶ 2<sup>nd</sup> rib issues can be a pain in the neck but also risk pain down the arm due to it's close proximity to the brachial plexus.
- ▶ Thoracic mobility is vitally important to normal rib function
- ▶ Repeated subluxations or pain in the same rib region point to musculoskeletal imbalance (look at scapula motion, shoulder range of motion and posture to identify tight vs weak muscle groups).



# Sacroiliac Joint

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- ▶ The sacroiliac (SI) joint is where the sacrum connects with the iliac bone of each side of the pelvis. Thus, there are technically two SI joints.





# SI Joint continued

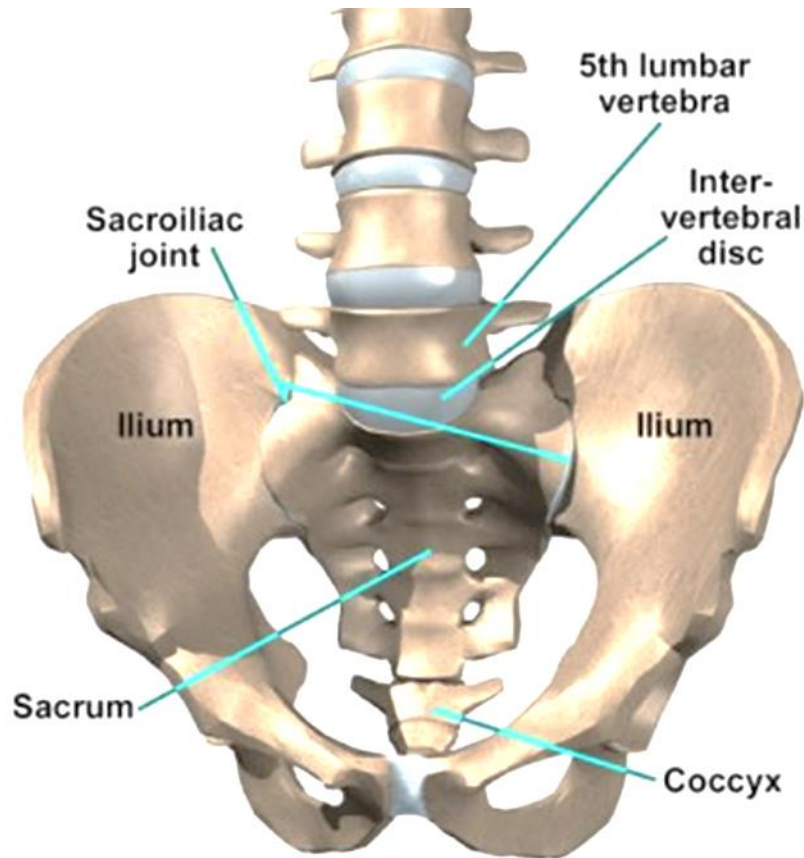
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- ▶ There can be two distinct problems with SI joint.
  - ▶ Sacroiliac problem– where the sacrum is not positioned or moving correctly on the innominate (1 pelvic side or ilia bone).
  - ▶ Iliosacral problem– where the innominate is not moving properly on the sacrum



# The Innominate (1/2 pelvis)

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- ▶ Possible Problems
  - ▶ Upslip or Downslip
  - ▶ Anteriorly Rotated
  - ▶ Posteriorly Rotated
  - ▶ Pubic dysfunction
  - ▶ Inflare or Outflare



# SI Joint Indicators

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- ▶ Pain in the lower back around the level of the low-back dimples (this is next to the posterior superior iliac spines which are abbreviated PSIS).

We can use the PSIS to determine if there is an SI joint dysfunction with a motion test.



# SI Joint Indicators

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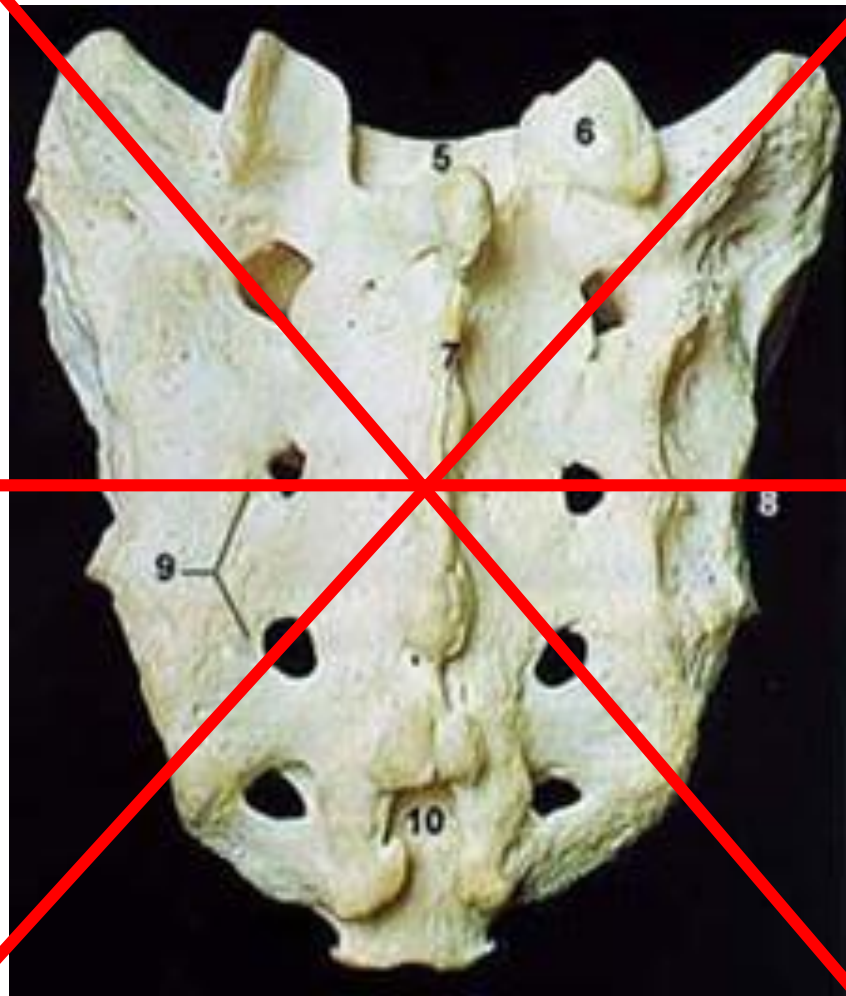
- ▶ Most SI joint problems cause discomfort on either the Right or Left side, not commonly both.
- ▶ Mechanical in nature where movement into flexion or extension will hurt more.
- ▶ Athlete can perform most activities but risk of more mechanical disruption is possible (sacrum or spine)
- ▶ Most athletic trainers are aware of Innominate assessment and basic fixes, but seeing the athlete repeatedly means the primary problem is not getting fixed.
- ▶ The sacrum or lower lumbar area could be involved and commonly increase pain that could be across the low back

# Sacral Axes & Movement

Left Oblique  
Axis

Right Oblique  
Axis

Transverse  
Axis



# Lumbar Spine vs. Sacrum

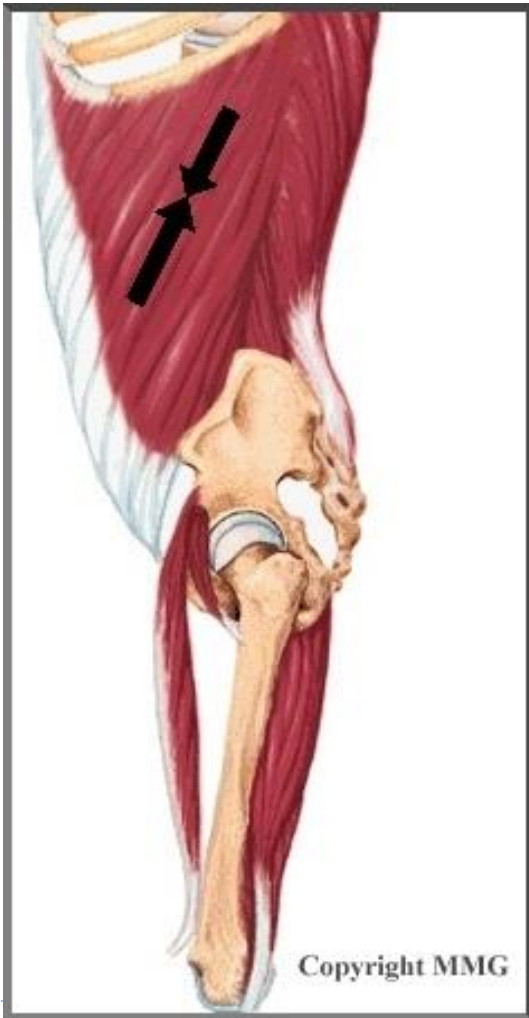
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- ▶ When the lumbar spine flexes, the sacrum posteriorly nutates (extends)
- ▶ When the lumbar spine extends, the sacrum anteriorly nutates (flexes)
- ▶ Abnormal mechanics in the lumbar spine can negatively affect sacral movement.
- ▶ Abnormal sacral position directly affects the pelvis and proper pelvic motion.
- ▶ A lumbar or sacral problem could produce SI joint pain and dysfunction. If so, simply fixing the innominate is not going to fix the problem. You need to be able to fix the lumbar and sacral problem.

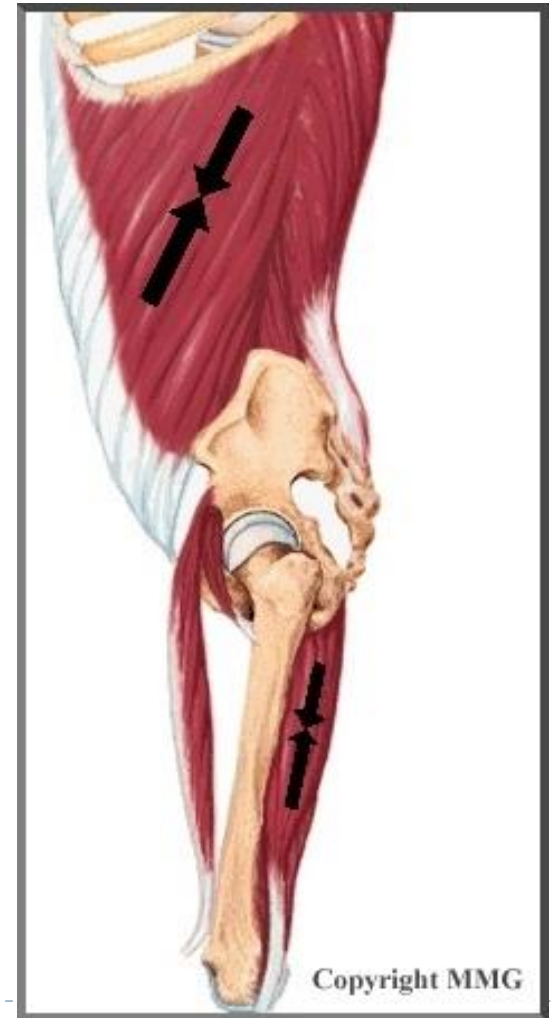


# Causes of Posterior Tilt in the Pelvis

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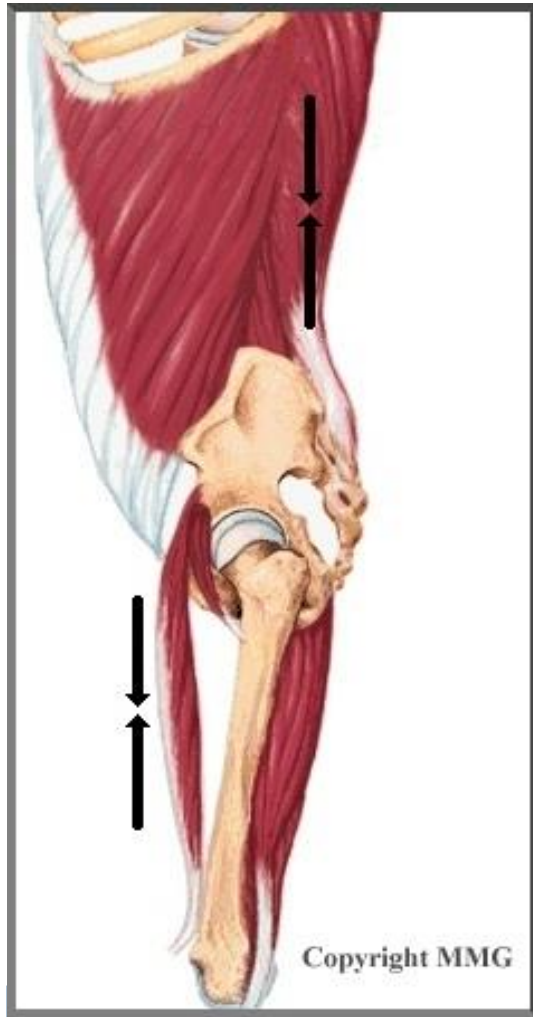


Hamstrings and  
Abdominals  
can produce  
posterior  
pelvic tilt

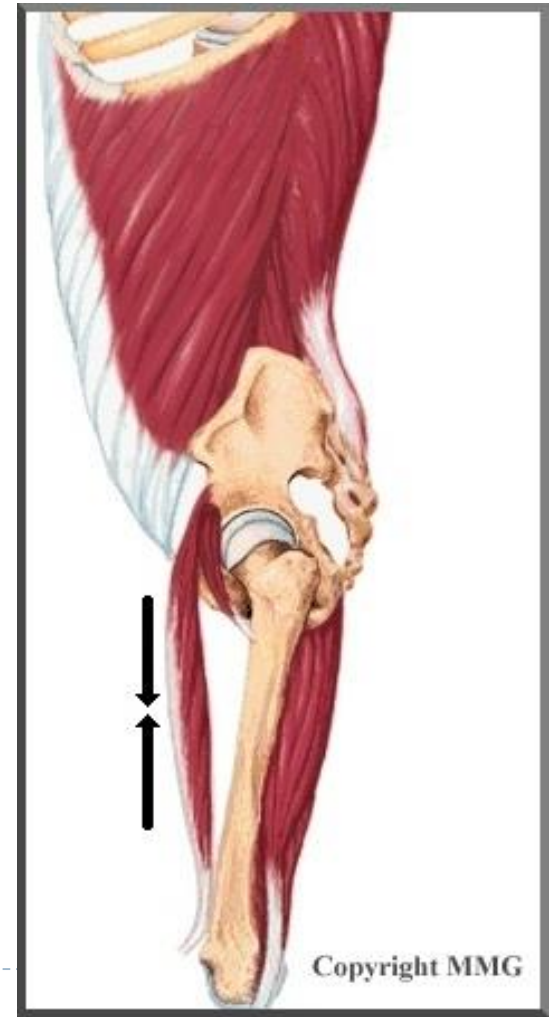


# Causes of Anterior Tilt in the Pelvis

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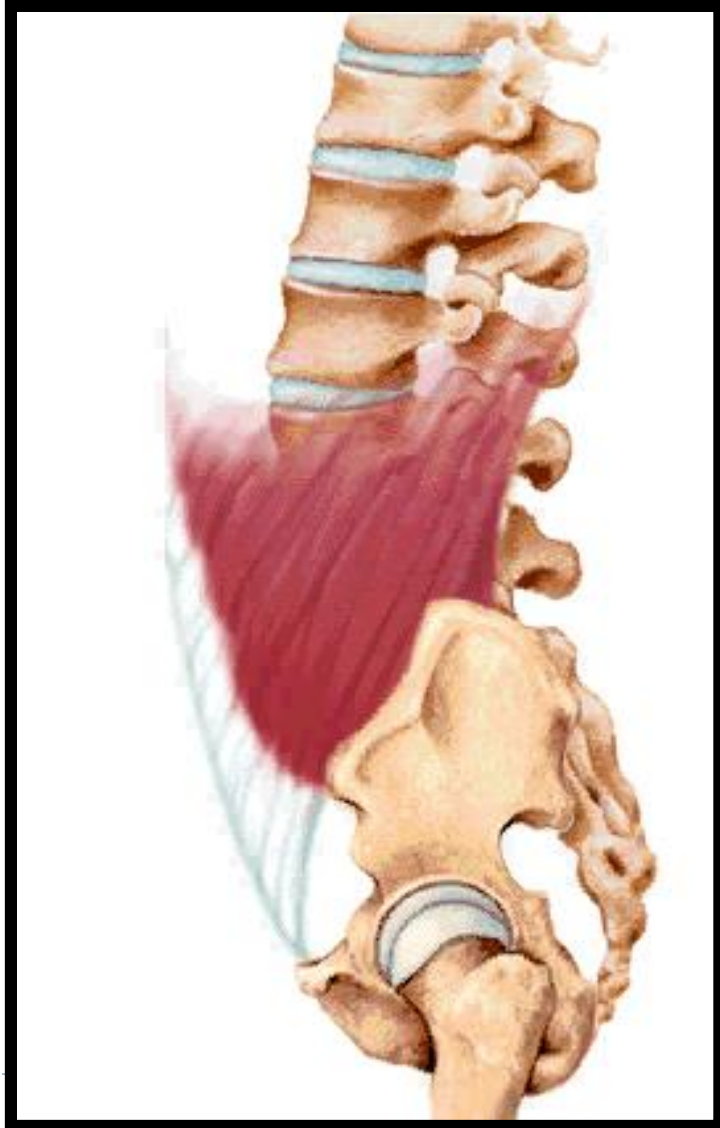
Back Extensor  
or Hip Flexors  
can produce  
anterior pelvic  
tilt





# Weak Abs/Tight Hip Flexors

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- ▶ This is a common combination. Weak abs which tilt the pelvis anteriorly, thus shortening the hip flexors. Over time this shortening becomes adaptive and restricts posterior pelvic movement
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# Understanding Neutral Pelvis

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- ▶ Ability to maintain a neutral pelvic position (neither anteriorly or posteriorly tilted) is important for low back stability.
- ▶ This position should be maintained for core strengthening exercises
- ▶ Key position to teach back pain patients to hold during daily posture, activities and exercise.

- ▶ Will weak abs increase or decrease Lordosis in the lumbar area?

Normal Curvature



Excessive Lordosis



# SI Joint Exercises

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- ▶ These are subtle exercises to emphasize SI joint movement without multiple joints involved which can compensate for SI immobility.
- ▶ Hip ER stretch with core hold
- ▶ Supine Knee toward Chest (hold with isometric hip extension)
- ▶ Supine core hold, knees bent to 90, feet on floor, ball squeeze with core hold 5-10 seconds
- ▶ Same as above but theraband resistance for abduction while holding core. Gradual progression on distance into abduction.
- ▶ Nuttal diagonal reaching exercise.



# Low Back Pain Epidemic

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- ▶ Up to 80% of low back pain is considered to be idiopathic (actual cause or origin unknown)
- ▶ In the general population this is the most common form of back pain.
- ▶ According to a 2006 review (Katz), total costs associated with LBP in the United States exceed \$100 billion per year, two-thirds of which are a result of lost wages and reduced productivity.

# Low Back Pain in Athletes

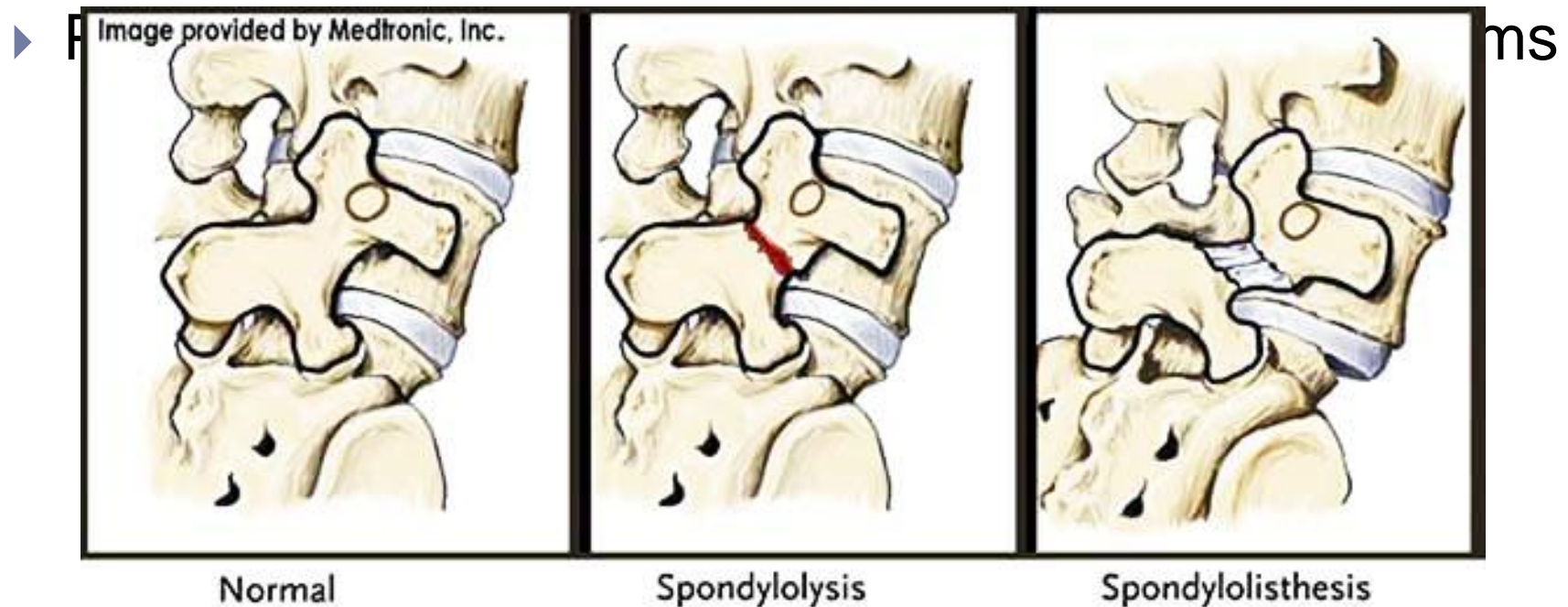
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- ▶ Generalized back pain is still the most common form of back pain in college athletes.
- ▶ Based on a review of numerous publications (US and international), the more common forms of diagnosed or specific back pain is spondylolysis (with some accompanying spondylolisthesis), discogenic, facet impingement and SI joint.
- ▶ Let's quickly take a look at what these terms mean.



# Spondylolysis

- ▶ Spondylolysis is also known as a “scotty dog fracture”
- ▶ Younger patients have good potential to return to normal activity with proper rest, unloading and proper core work.



# Spondylolisthesis

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50% due to Pars fracture  
20% congenital (no fracture)  
30% older population –  
degenerative lumbar facets that  
allow displacement

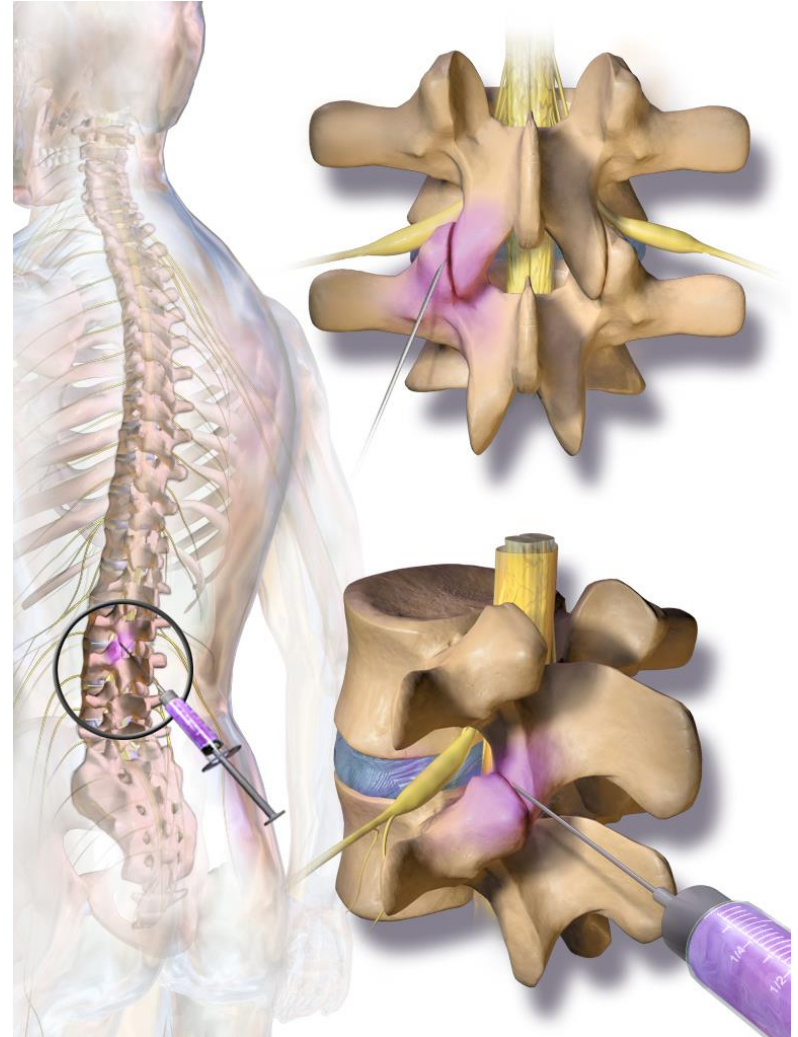
Forward slippage of a lumbar vertebrae on the vertebrae below it

- ▶ A secondary effect of spondylolysis due to fracture of the pars interarticularis.
- ▶ Distance of slipping determines severity of disc, joint, and neural involvement.
- ▶ Extension is more painful in this condition.

# Facet Impingement

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- ▶ In my opinion this is one of the most common forms of acute back pain.
- ▶ Can be temporarily debilitating and painful
- ▶ Acute back pain is different from Facet Joint Syndrome which is more chronic and involves facet hypertrophy, inflammation and facet arthritis.





# Facet Impingement

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- ▶ The facet joint has a capsule that can sometimes get “impinged” or pinched between the 2 articular surfaces.
  - ▶ When this happens it will get inflamed and be painful. It will also restrict motion at that joint and make it difficult to open or close the facet joint.
  - ▶ <https://www.youtube.com/watch?v=9w6NiPc8Bp8>
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# Facet Joints

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- ▶ Facet Joints help guide the proper motion for the spinal segment
- ▶ Important for helping carry the load on the spine and an important resisting shear loads in the lumbar spine.
- ▶ Joint capsules have their own nerve innervation which adds to pain syndromes
- ▶ Acute pain (lasting up to 7 days) and subacute pain (up to 3 months) seem related to capsule damage, and chronic pain is probably related to osteoarthritis.
- ▶ Disc degeneration and facet joint stress go hand in hand

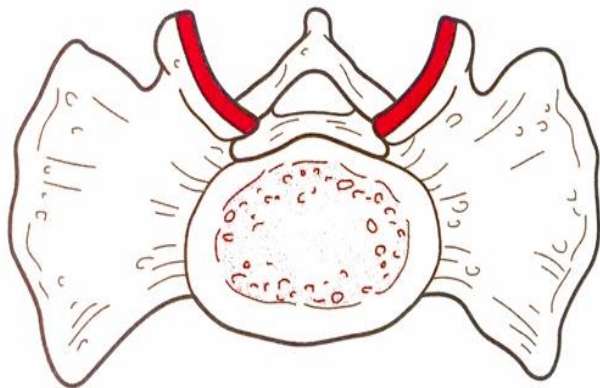
Biomechanics of the Posterior Lumbar Articulating Elements

▶ Hassan A. Serhan, Ph.D.1; Gus Varnavas, M.D.2; Andrew P. Dooris, Ph.D.1; Avinash Patwardhan, Ph.D.3; Michael Tzermiadianos, M.D.3 , Neurosurg Focus. 2007;22(1)

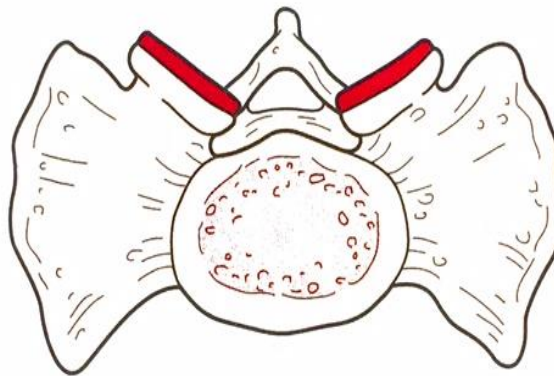
# Tropisms

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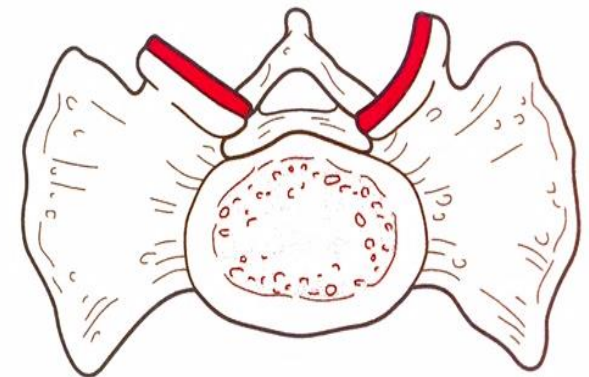
- ▶ Abnormalities that can occur in the shape of the facets. Somewhat common to find at the L5-S1 level
- ▶ Can produce abnormal amounts of facet joint stress and degeneration with difficulty in particular movements for that segment.



HALF-MOON SHAPE  
12%



FLAT (NORMAL)  
57%



ASYMMETRIC HALF-MOON,  
HALF-FLAT SHAPE  
31%

# The Intervertebral Disc

- ▶ **Discogenic** pain means that the disc is the source or cause of the pain.
- ▶ Early degeneration or disc damage results in annular tears and the disc gradually shifts and bulges. Can eventually cause nerve pain.

Understanding mechanics and what can increase disc pressure is important for understanding how to reduce disc loading

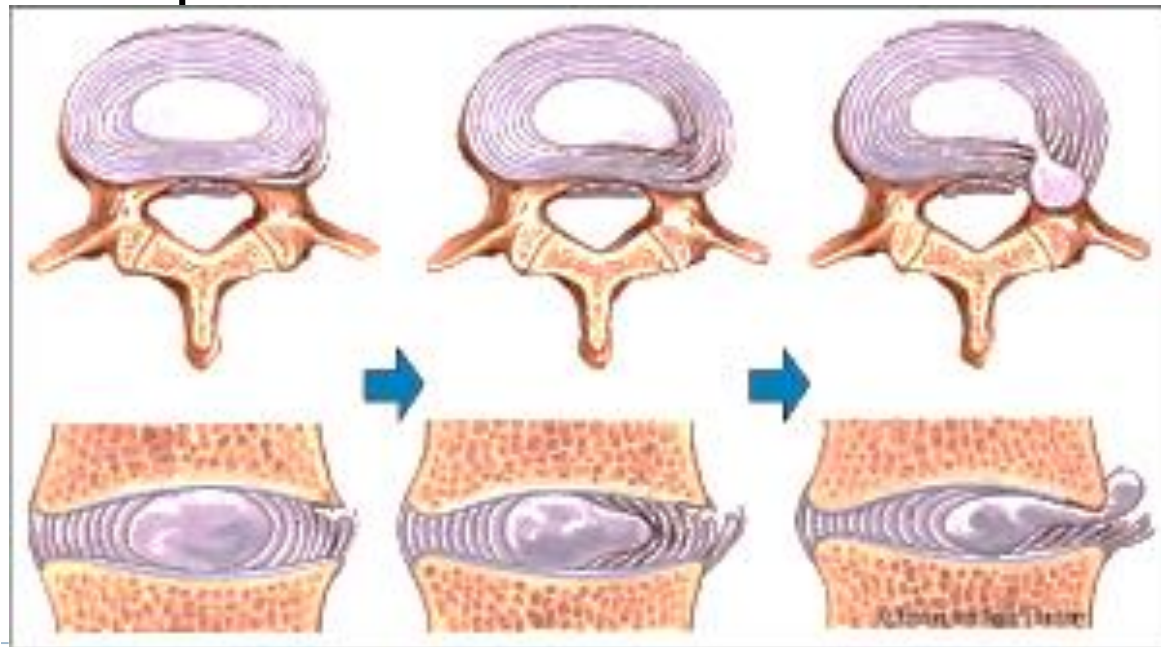


Image from <http://grandechiro.com/north-vancouver-chiropractor-discusses-the-difference-between-disc-protusion-and-disc-prolapse/>

# What's a Slipped Disc?

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- ▶ What's a patient supposed to think when they see a model like this in the Dr's office?
- ▶ Discs cannot “slip”



# Intervertebral Discs

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- ▶ Made up of 3 parts:
  - ▶ Annulus Fibrosus
  - ▶ Nucleus Pulposus
  - ▶ Vertebral Endplate
    - ▶ A 1mm thick plate of hyaline cartilage that helps attach the disc to the body of the vertebrae above and below



Intervertebral Disc.

BSIP/UIG/Collection:Universal Images  
Group/Getty Image

# The Intervertebral Discs

## Nucleus Pulposus

- is the **central** portion of the disc (except L-spine; post.)
- it is a loose collagen fibril network contained within an extensive gelatinous matrix (primarily Type II collagen)
- at birth the nucleus contains a high portion of proteoglycans (made up of glycosoaminoglycans; GAGs), decreases with age and is replaced by collagen (**degeneration begins to occur after age 20**)
- imbibing properties of the proteoglycans lead to nucleus' ↑ % water: at birth 85%, 6<sup>th</sup> decade 65%




# The Intervertebral Discs

## **Nucleus Pulposus** Functions:

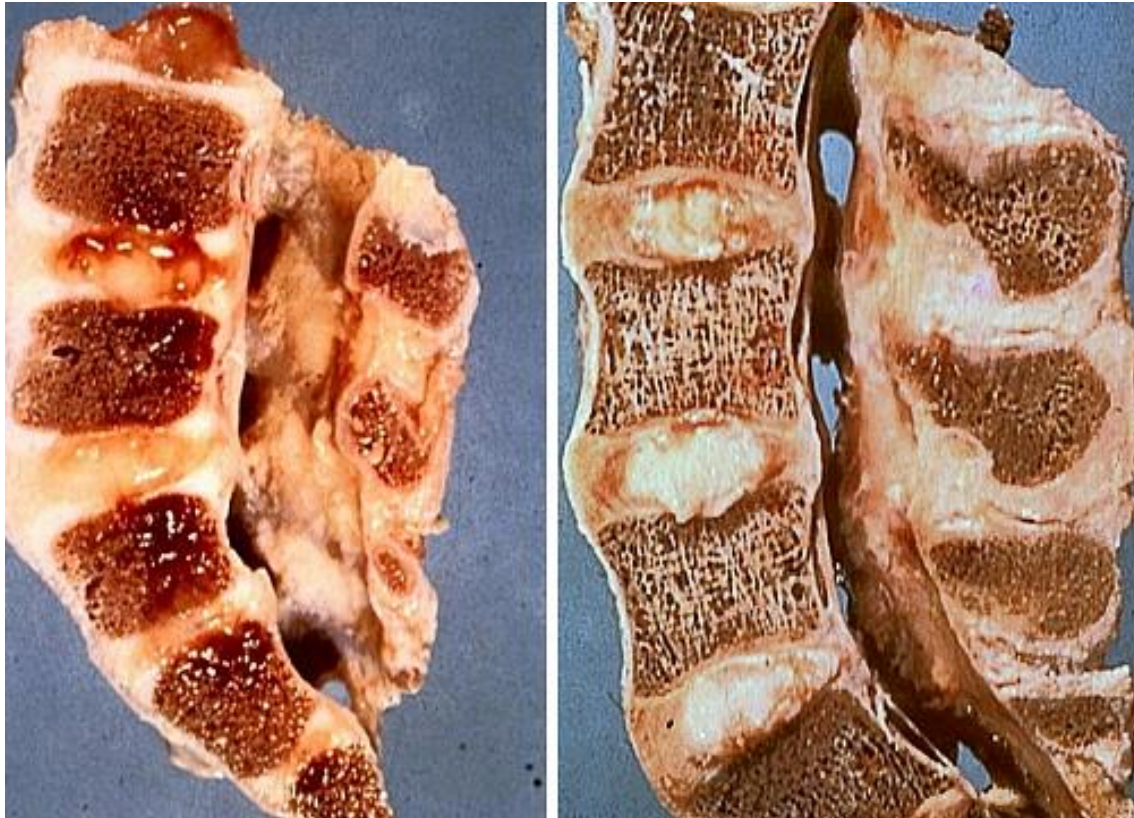
- Imbibition (taking up and holding fluid); if released from confining annulus, is able to swell up 200-300% in hours!
- Transmission of force: its **incompressibility** is responsible for transmitting much weight across the spinal segment
- Equalization of stress: hydrostatic property of transmitting forces equally in all directions
- Movement: provides “rocking” action to movement

Nutrition: only the periphery of the disc is **vascularized**, ⇒ receives nourishment via diffusion from the periphery of the **annulus** and the vertebral endplate

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Left: discs from an individual in his late teens.

(Note that the nucleus is extremely gelatinous and very large.)

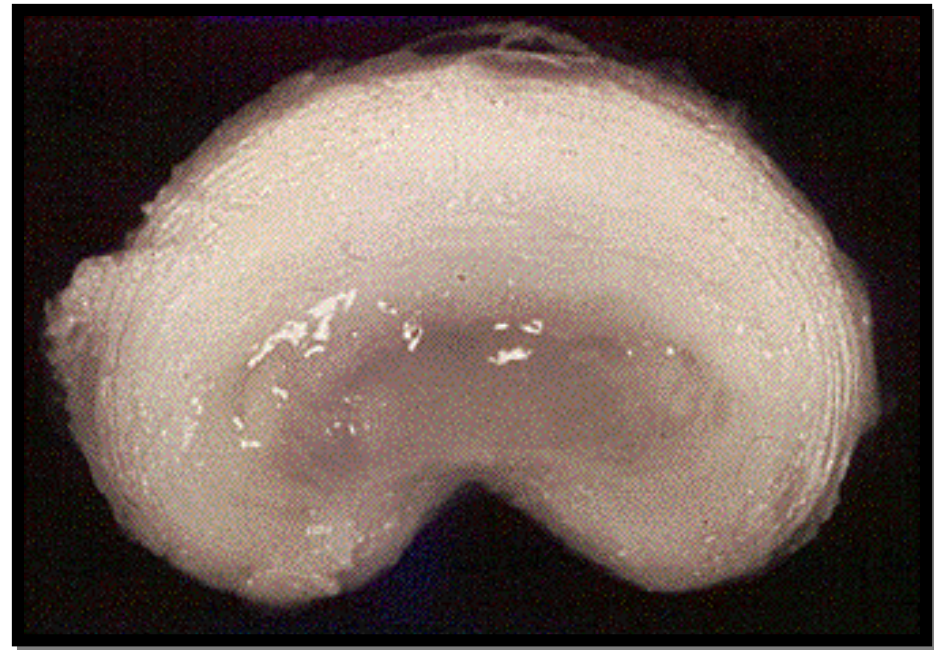
Right: from a 28-year-old individual; the gelatinous nucleus has disappeared somewhat.

(Note that this sagittal cut was washed and arranged, and while the photographer was preparing the camera, the intervertebral nucleus bulged outwards quite extensively demonstrating its affinity for absorbing water. A young nucleus can absorb two to three times its volume of water.)

# Nucleus Pulposus

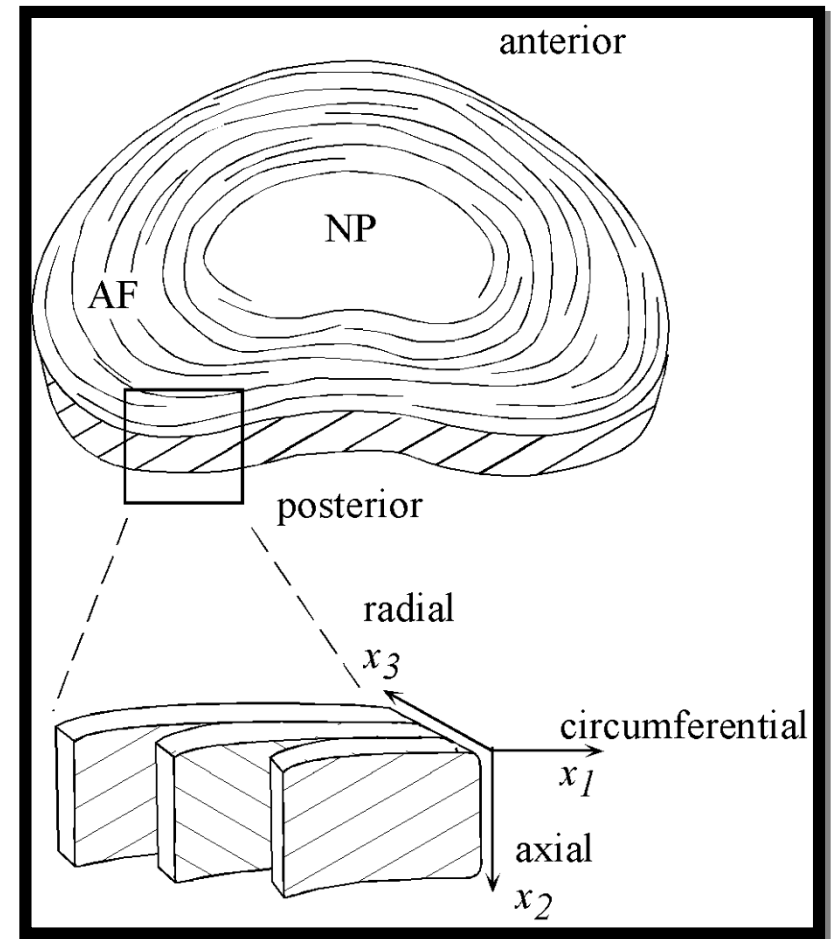
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- ▶ Lies around the center of discs in cervical and thoracic spine
- ▶ More posterior in Lumbar spine
- ▶ Primarily handles compressive stress
- ▶ Degeneration also includes a loss of disc height which then causes more load to be placed on the facets.



# Annulus Fibrosus

- ▶ Made up of about 20 concentric rings
- ▶ Fiber pattern in each ring is offset (some sources say  $120^\circ$  and some say  $60^\circ$ )
- ▶ Handles Compression, Shear, and Torsional forces
- ▶ Outer layers are well innervated and contribute to discogenic pain when it bulges



## MOVEMENT WITHIN SPINAL SEGMENT

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- ▶ Forward bending:
  - ▶ Vertebra rocks over nucleus
  - ▶ Facets slide up – 40% displacement
  - ▶ Anterior disc is loaded and annulus bulges anteriorly
  - ▶ Posterior disc is drawn taut and may become convex
  - ▶ Nucleus deforms posteriorly

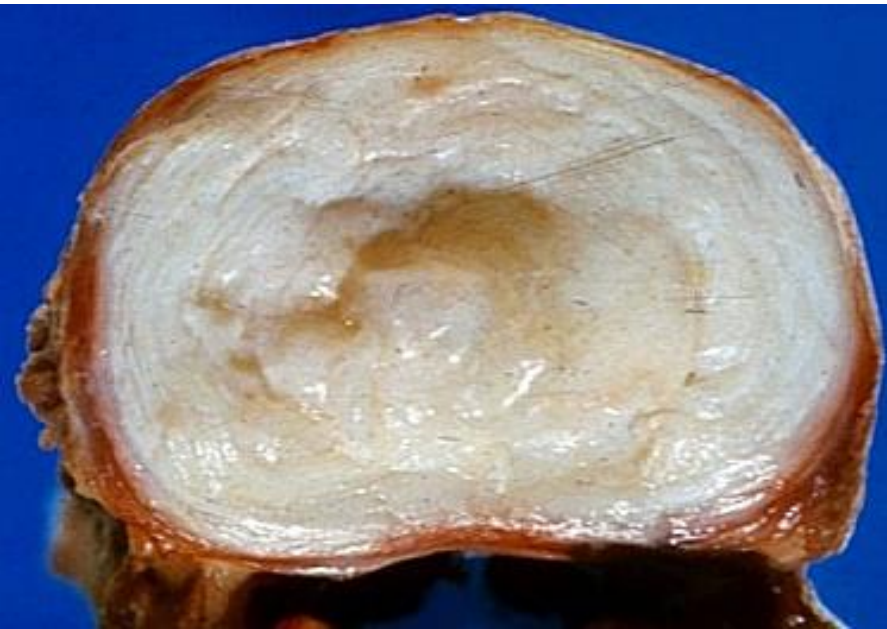


# Movement within spinal segment

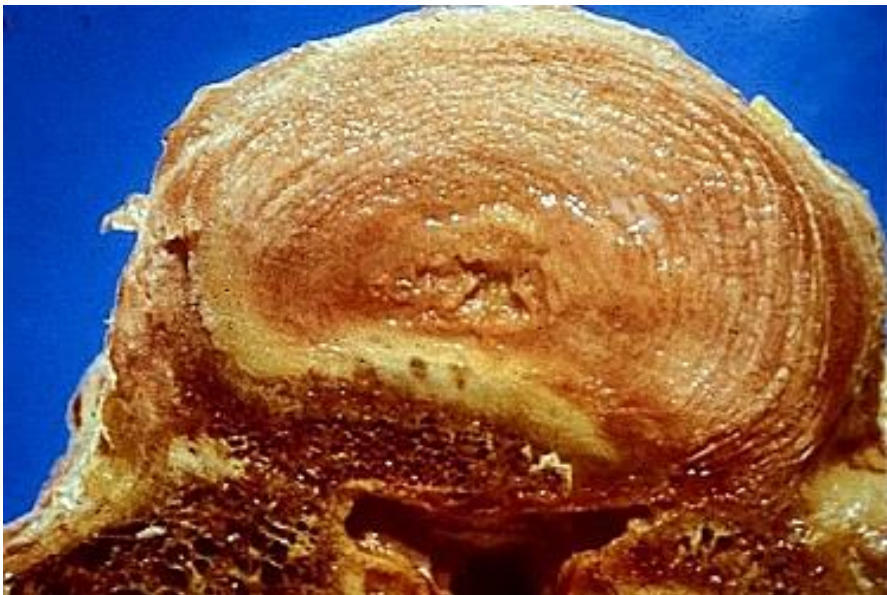
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- ▶ **Backward bending:**
  - ▶ Vertebra rocks over nucleus
  - ▶ Facets slide down and contact the lamina below
  - ▶ Posterior disc is loaded and annulus bulges posteriorly
  - ▶ Anterior disc is drawn taut
  - ▶ Nucleus distorts anteriorly
  - ▶ With continued bb facets become a fulcrum, the disc space undergoes distraction



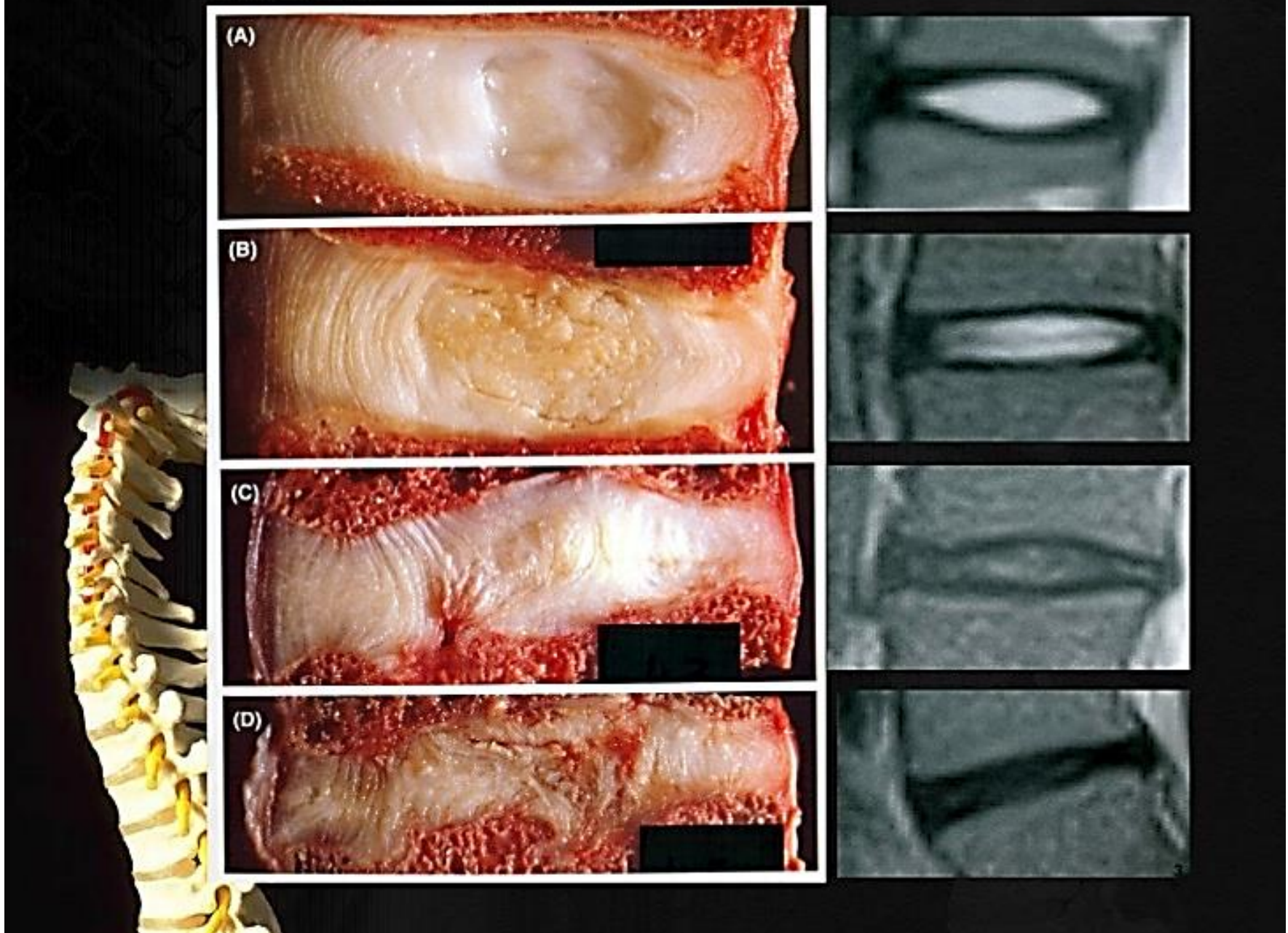


This picture shows a disc from an individual in his thirties. Note the vascular capsule and the “creamy” nucleus.



A disc from an individual in his fifties. The nucleus is a gelatinous structure that over time becomes dense collagen.





# Questions

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- ▶ What is the most detrimental movement for the disc?
- ▶ Functions of the nucleus pulposus
- ▶ What “feature” makes the nucleus incompressible?
- ▶ What pathology could be associated with a fracture of the vertebral endplate (superior/inferior direction)?



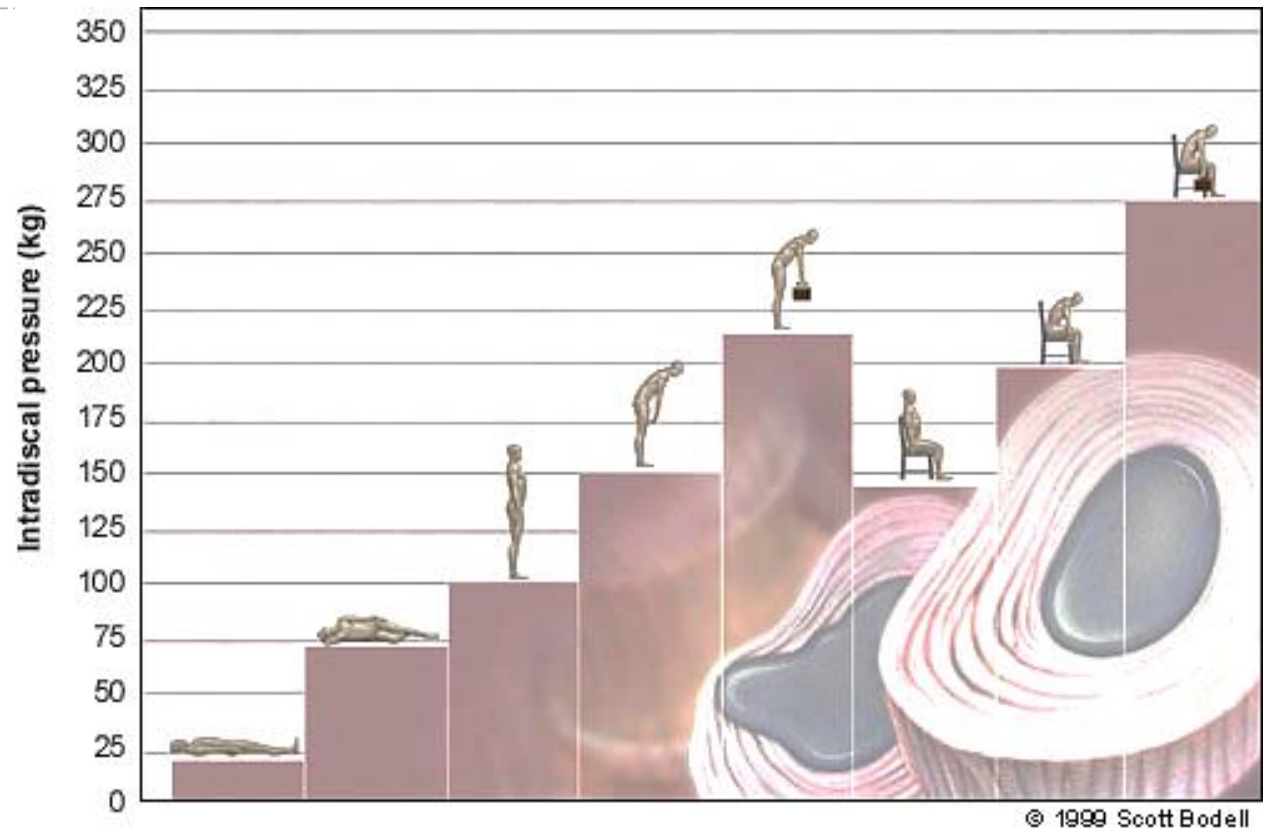


# Lumbar pain

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- ▶ Lumbar pain presents in the bulk of the paraspinal or low back musculature. It is often unilateral but under certain circumstances can be bilateral.
  - ▶ A decent amount of flexion and extension available as well as rotation.
  - ▶ Sidebending better at top portion and limited in lower
  - ▶ Clinically I use sidebending as quick screen for lumbar dysfunction (especially when I am looking at an SI joint problem). Normally sidebending will produce a nice C or reverse C shape (depending on which side you lean), but lumbar issues will normally cause this to decrease and the lumbar area will stay straight.
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# Intradiscal Pressures by Position (as adapted from Nachemson)



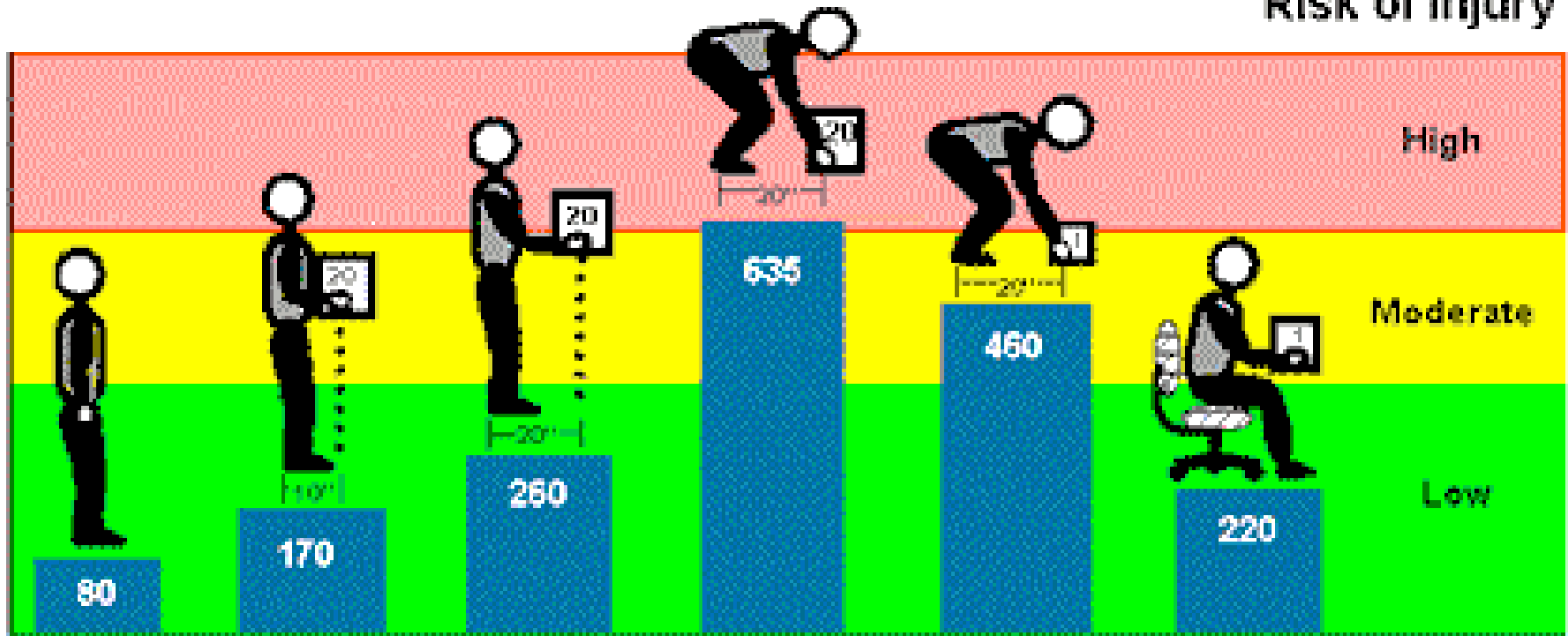
Relative increases and decreases in intradiscal pressure in relation to different body positions. Note that seated and bending postures apply more pressure to the disc than do standing and recumbent positions. This explains the exacerbation of symptoms of herniated disc when patients are in the former positions.

# Activity and % Increase in Disc Pressure at L3

|                                                                 |          |
|-----------------------------------------------------------------|----------|
| Coughing or Straining                                           | 5% - 35% |
| Laughing                                                        | 40%-50%  |
| Walking                                                         | 15%      |
| Side bending                                                    | 25%      |
| Small jumps                                                     | 40%      |
| Bending forward                                                 | 150%     |
| Rotation                                                        | 20%      |
| Lifting a 20kg weight with the back straight and knees bent     | 73%      |
| Lifting a 20kg weight with the back bent and the knees straight | 169%     |

# Pounds of compressive force on lower back

Risk of Injury



Standing upright

Standing upright, lifting 20 lbs. 10" away from low back

Standing upright, lifting 20 lbs. 20" away from low back

Bent over, lifting 20 lbs. 20" away from low back

Bent over, lifting 1 lb. 20" away from low back

Sitting, leaning forward and lifting 1 lb.

Why do we do this? What's wrong with this picture?

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# Intervetebral Discs

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- ▶ Compressive loads on the disc are about 1.5 times the externally applied load
- ▶ As the disc is compressed, the disc bulges laterally (which places stress on annulus)
- ▶ Stress on the posterior part of the annulus in the Lumbar spine is estimated to be 4 or 5 times greater than the external compressive load when moving into some flexion
- ▶ Overall, standing with flexion increases pressure and further increased with rotation
- ▶ A biomechanical study reported that one hand support on the thigh during lifting of objects from the floor can reduce low back loading by up to 28%

# 4 Factors That Increase Load on the Spine- when carrying an object

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1. Position of the object relative to the center of load on spine
2. Size, shape, weight, density of object
3. Degree of flexion and rotation of spine
4. Rate of loading



# The Importance of Abs

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# Spinal Stability- Core Training

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- ▶ It's NOT all about Abs  
Abs Abs.
- ▶ Abs are important, but  
None of our back pain  
patients have been  
helped when it's the  
main focus.
- ▶ Core training is  
everything between  
your lower chest and  
pelvis. So it also  
includes the erector  
spinae and lots of  
stabilization



# Let's Discuss the Good or Bad of Core Exercises with Regard to Spinal loading



# The Frog for Core? Why Horizontal Compression could be beneficial.



▶ Let's discuss the mechanics involved

# Core Exercise and the Back

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- ▶ Bent knee vs straight leg sit-ups are equally bad for compressing spine
  - ▶ Remember that the psoas major originates from the bodies and transverse processes of the lumbar vertebrae
- ▶ Sit-ups with legs unattached, elevated, or with torso twisting does not activate more abdominal muscles
- ▶ Reverse curl limits psoas activity the most and helps to decrease load with effective strengthening
- ▶ Lying with legs supported (hips and knees bent) decreases the load on the spine (reduces psoas tension)

# Intra-Abdominal Pressure

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- ▶ Can contribute to unloading and stability of the lumbar spine
- ▶ Research suggests the transverse abdominus and the diaphragm play an important role in stabilizing the spine for movement.
- ▶ Transverse abdominus contraction increases IAP without producing a flexion moment.
- ▶ Fatiguing of muscles supporting the spine results in increased couple motion (sidebending & rotation) during flexion and extension movement. Making one more prone to injury.



# Exercises I think are problematic

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## Bicycle Crunches and Sit-ups

The back has very little support when rotation occurs when dropping in & out of flexion. Increasing speed is even worse. A 2<sup>nd</sup> risk is forced neck flexion.

Sit-ups are a decent hip flexor workout, but there are safer ways to work out your hip flexors.

Sit-ups produce a large amount of Lumbar compression due to the Psoas major pulling up the entire Upper half of the body.



So what's a safe alternative?

WorkoutLabs.com

Image from: <https://thelifeinbloom.com/tag/bicycle-crunch/>

# Exercises I think are problematic

## The V-sit and V-sit with medicine ball rotation

Flex the spine, engage the hip flexors and then rotate to add a sensational amount of shear stress to your lower vertebrae and discs..... Great idea!

If you for some reason have to do this move.. Stop... just stop!

Neutral spine alignment.

This exercise would be better



Image from:

<http://seorank.info/viewgallery/5259.htm>



Image from:

<https://www.pinterest.com/vinsere/medicine-ball-workouts/>

# Warning – Sarcasm

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“Here, let me hand you my nucleus pulposus... I won't be needing it anymore!”



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Image from:

[http://www.fitxfitnessinc.com/partner\\_workouts](http://www.fitxfitnessinc.com/partner_workouts)



# Exercises I think are problematic

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## Backward medicine ball Toss or Backward rotation toss (against a wall)

As if the finishing position isn't alarming enough  
Backward rotational throws are even harder  
On the back, facets, and disc

What's a safer alternative?

Throwing the ball laterally is good for rotary  
Power if lateral and forward.



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Image from:

[http://www.verticaljumping.com/core\\_training.html](http://www.verticaljumping.com/core_training.html)

# Exercises I think are problematic

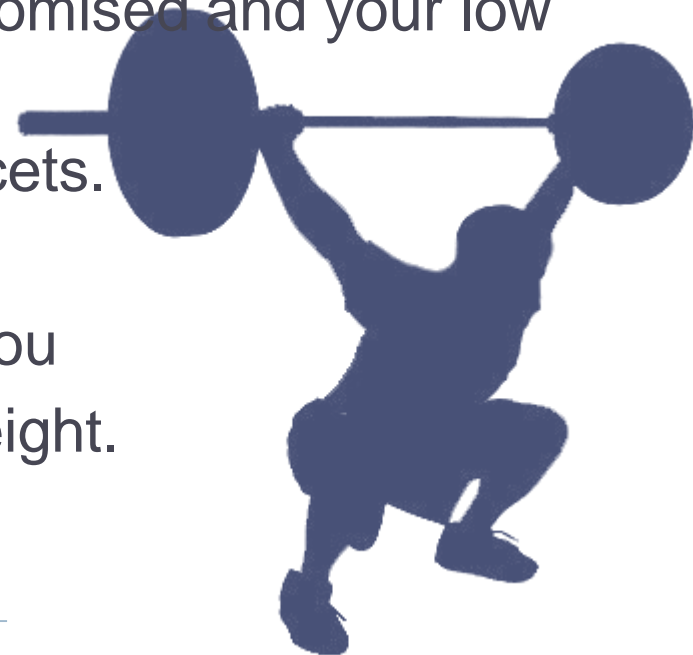
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## The Overhead Squat

Lack of mobility in the hips, knees or ankles will give people trouble getting into a deep squat and that is where the largest caution resides. Shoulder issues are common also. If you for some reason you prefer this move, stop the descent as soon as form is compromised and your low back arches too much.

It's hard on shoulders and thoracic facets.

Opinion: If you can't score a 3 on the Deep squat portion of the FMS then you Should not be doing this with extra weight.



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Image from:

<https://www.flickr.com/photos/33503690@N07/4651101650>

# Exercises I think are problematic

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## Romanian Deadlift

If performed correctly it is good exercise for the hamstrings and glutes.

Potential negative cost to the low back when you fall into too much low back extension while lifting and lowering the weight or round the back when picking it up or finishing.

No need to do heavy!

So, for athletes there is good Potential.

For the general population This is fraught with danger.



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Image from:

<https://www.youtube.com/watch?v=2SHsk9AzdjA>

# Better Alternatives (especially if you have any form of low back pain)

## Single-leg Romanian Deadlift or Back Extension

Good exercise for the hamstrings and glutes and stabilization.

Maintaining neutral back is the key to getting early hamstring when the knee should be slightly bent



Image from:

<https://loseyoself.wordpress.com/2015/01/24/master-class-romanian-deadlift/>

Image from:

<https://www.pinterest.com/pin/276689970826936351/>