Anatomy of the Spine

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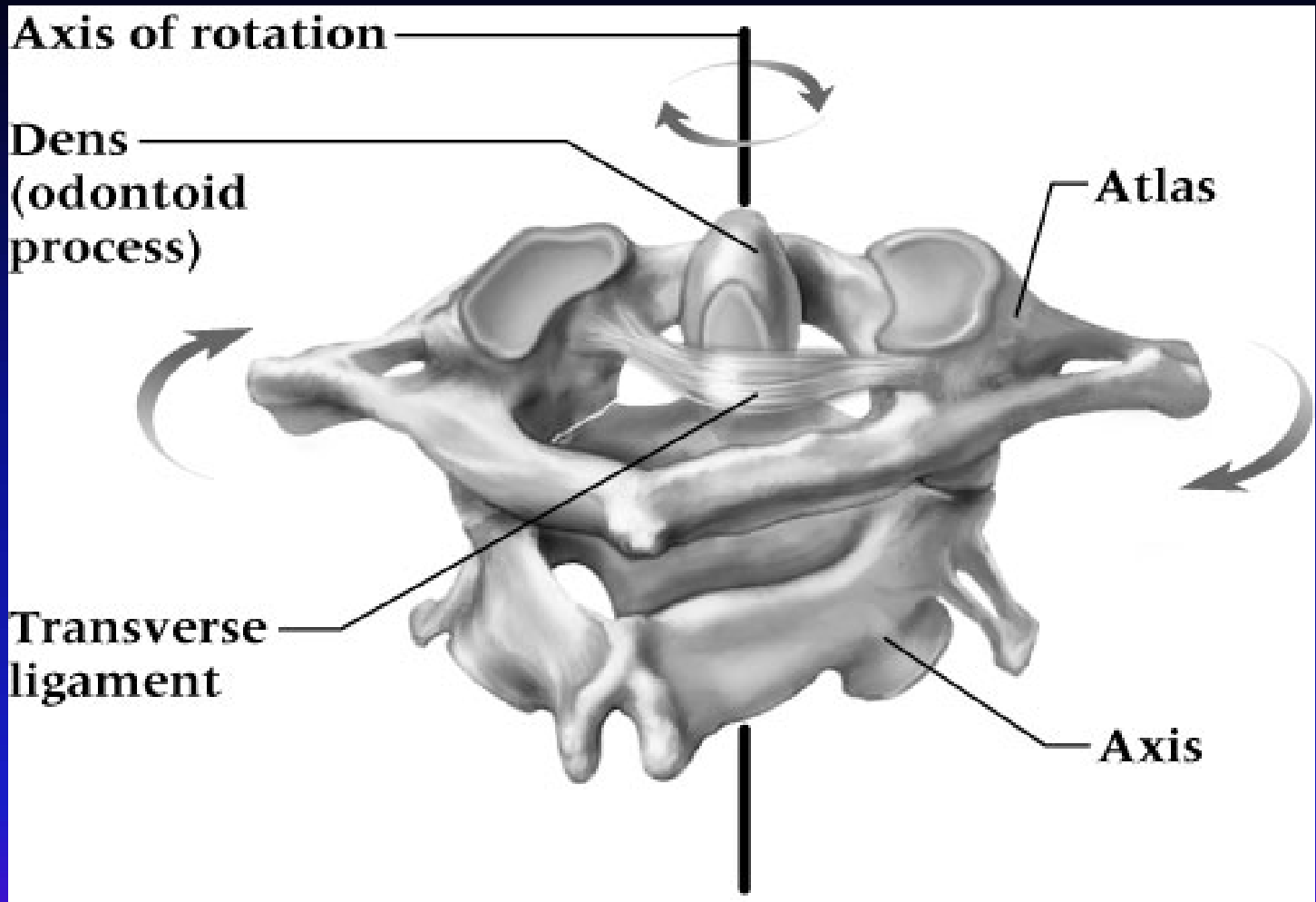
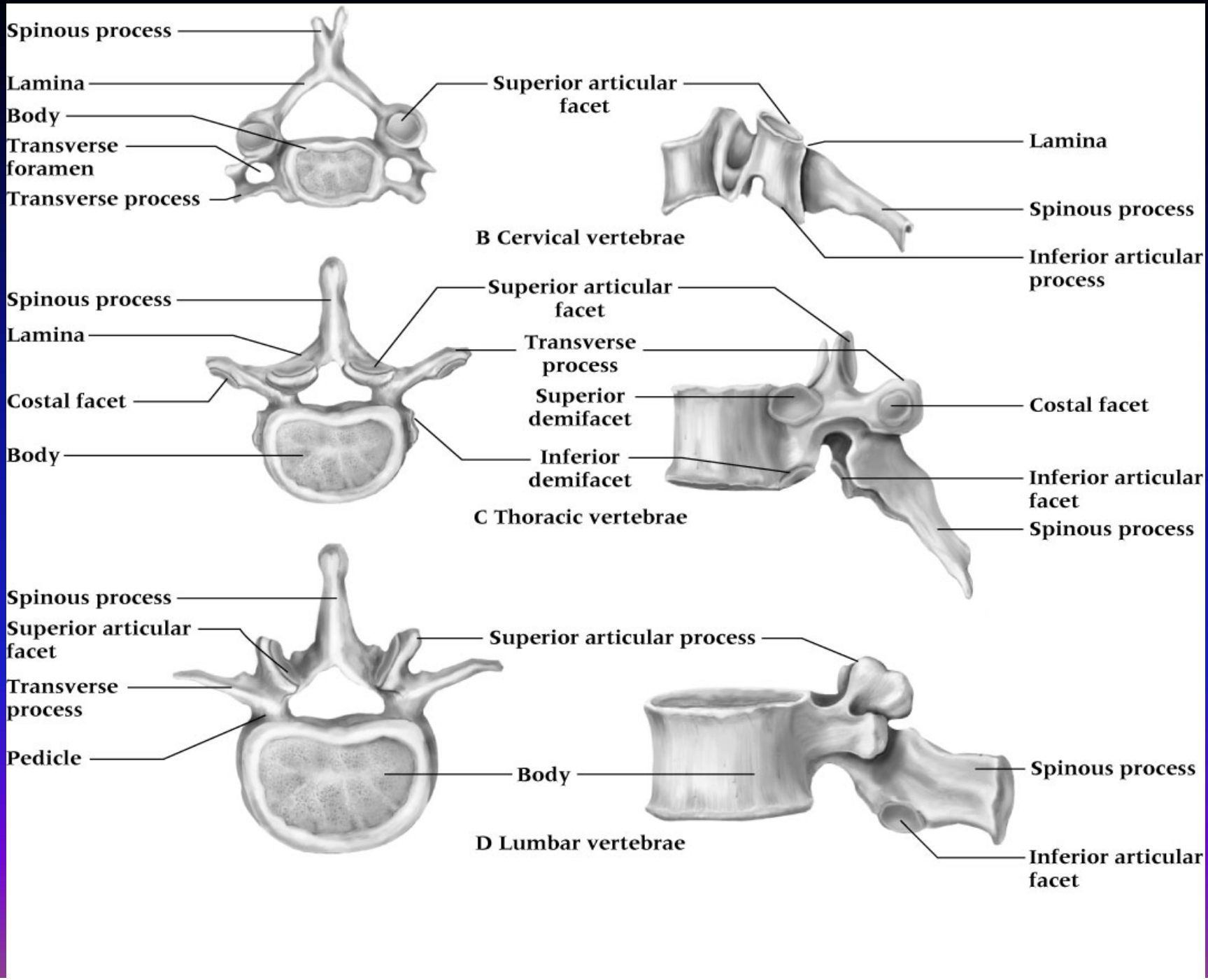
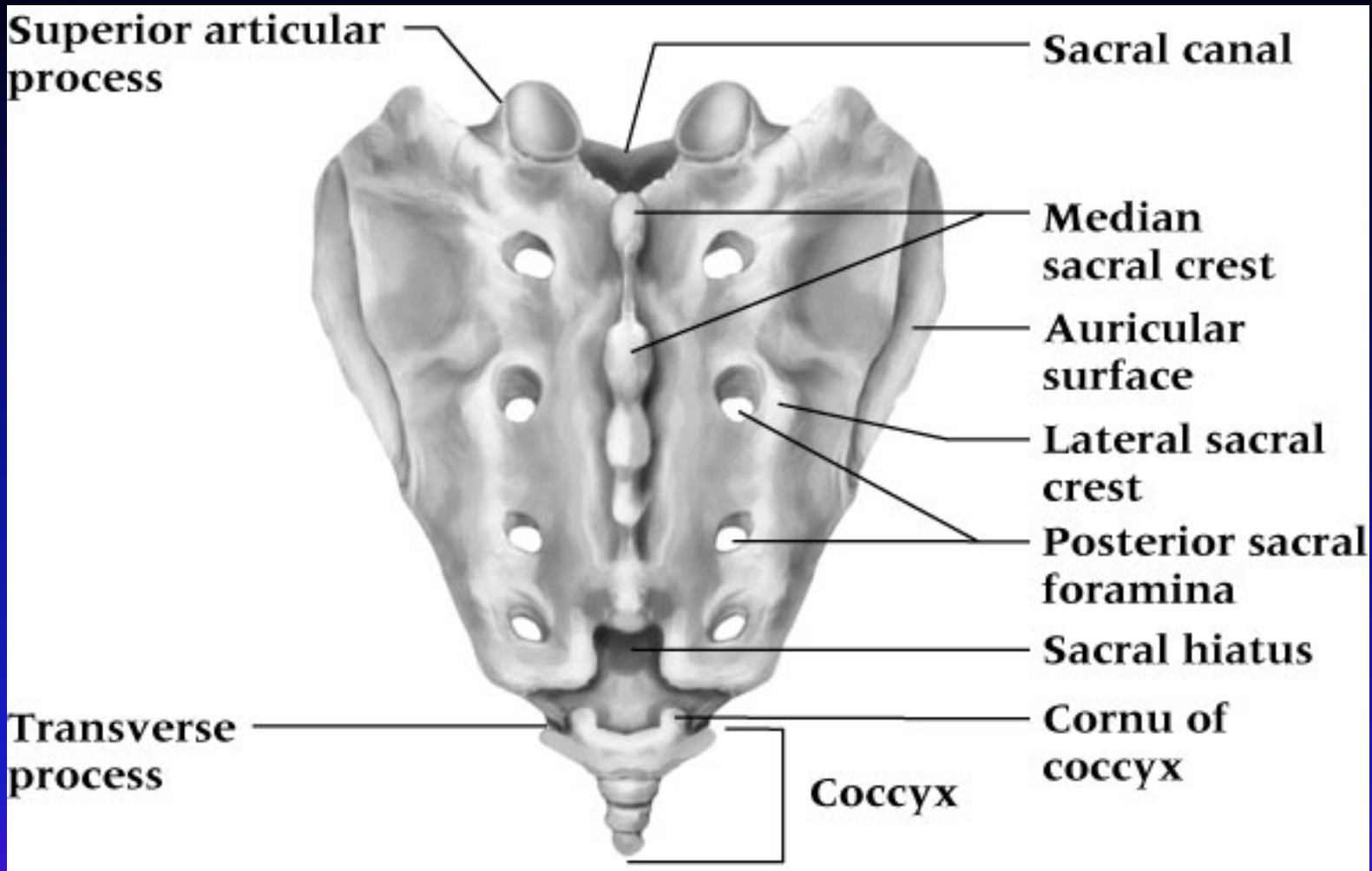


A Atlas and axis


Spinous process
Lamina
Body
Transverse foramen
Transverse process
Superior articular facet
Lamina
Spinous process
Inferior articular process
B Cervical vertebrae
Spinous process
Lamina
Costal facet
Body
Superior articular facet
Transverse process
Superior demifacet
Inferior demifacet
Costal facet
Inferior articular facet
Spinous process
C Thoracic vertebrae
Spinous process
Superior articular facet
Transverse process
Pedicle
Body
Superior articular process
Spinous process
Inferior articular facet
D Lumbar vertebrae



E Sacrum and coccyx

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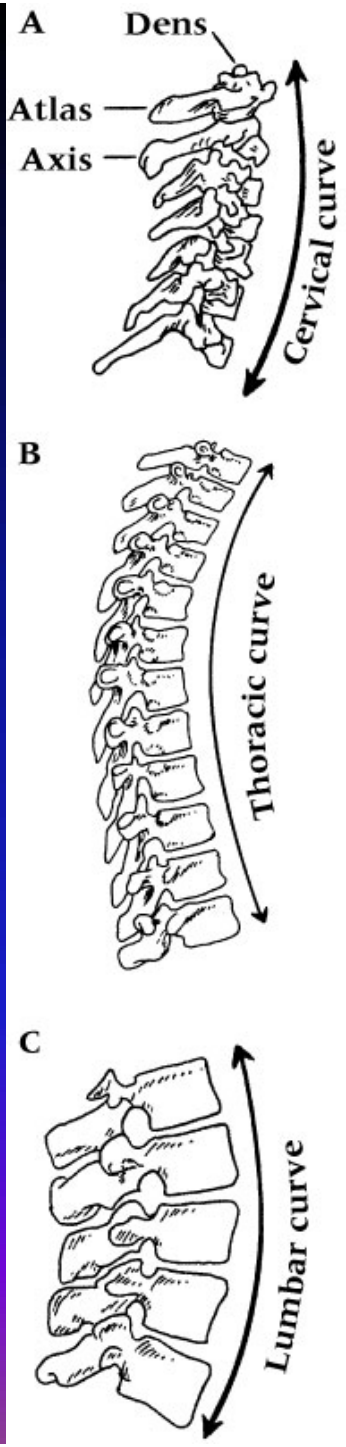
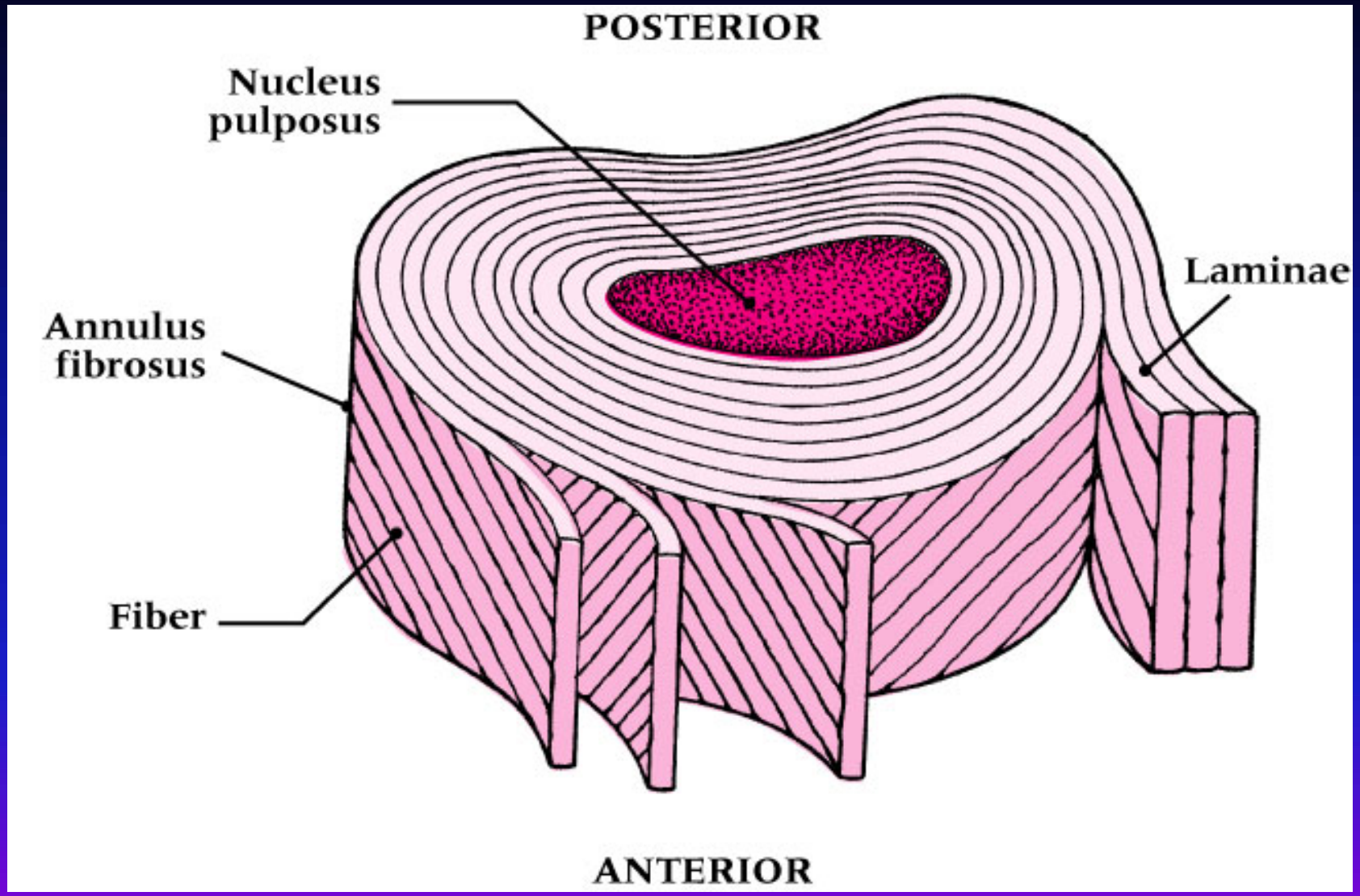
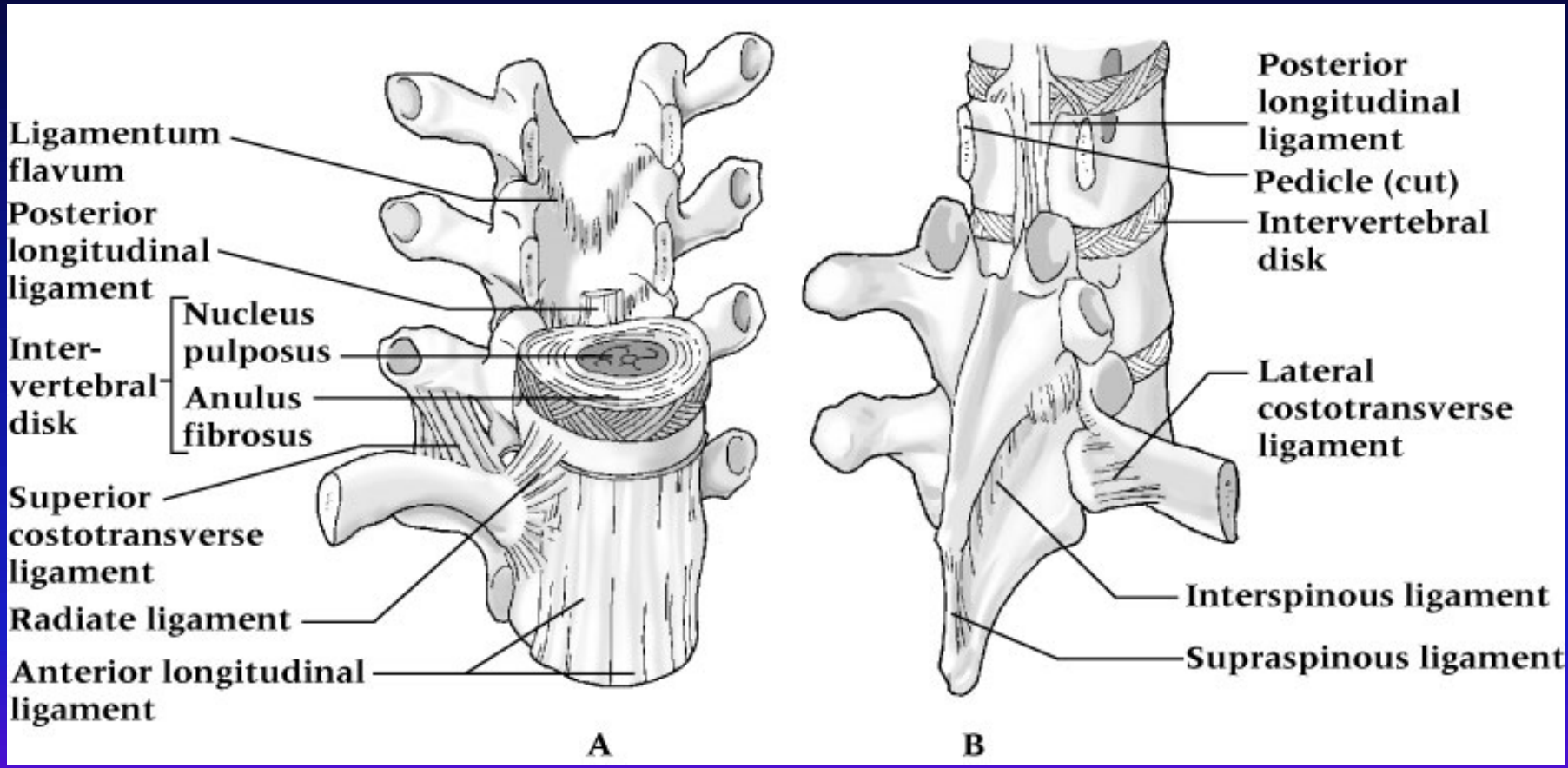
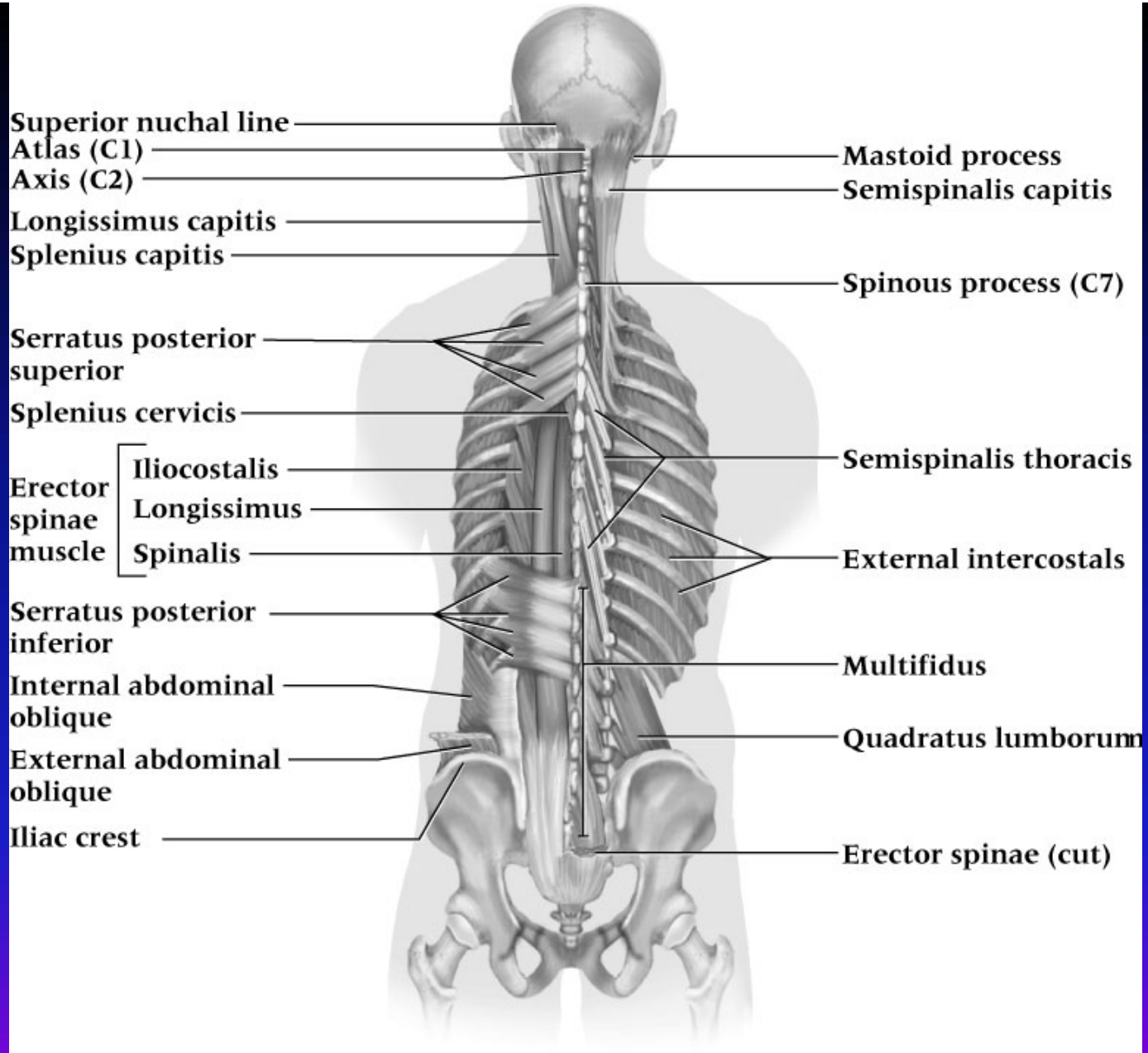
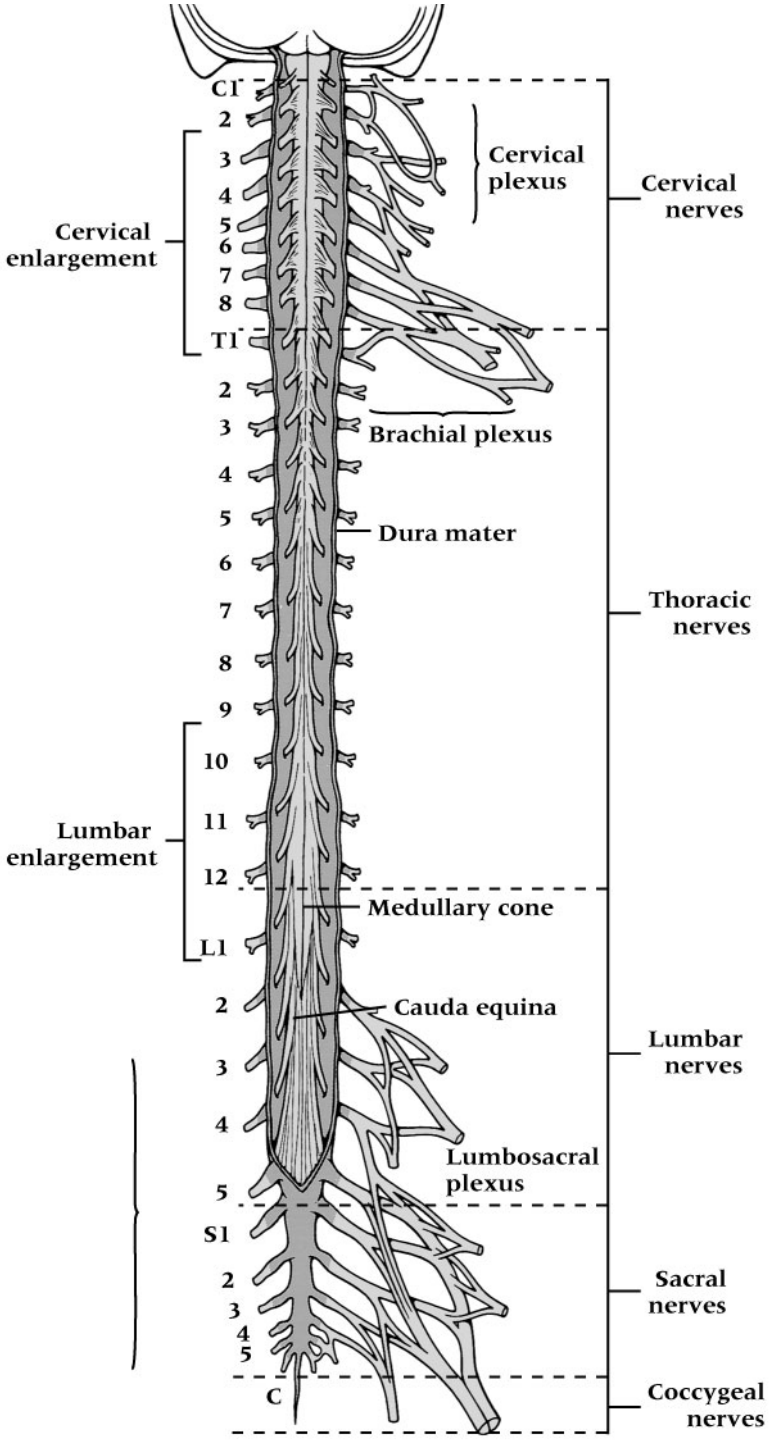

A
Dens
Atlas
Axis
Cervical curve
B
Thoracic curve
C
Lumbar curve


POSTERIOR
Nucleus pulposus
Laminae
Annulus fibrosus
Fiber
ANTERIOR


Ligamentum flavum
Posterior longitudinal ligament
Inter-vertebral disk
Nucleus pulposus
Anulus fibrosus
Superior costotransverse ligament
Radiate ligament
Anterior longitudinal ligament
A
Posterior longitudinal ligament
Pedicle (cut)
Intervertebral disk
Lateral costotransverse ligament
Interspinous ligament
Supraspinous ligament
B


Superior nuchal line
Atlas (C1)
Axis (C2)
Longissimus capitis
Splenius capitis
Serratus posterior superior
Splenius cervicis
Erector spinae muscle
Iliocostalis
Longissimus
Spinalis
Serratus posterior inferior
Internal abdominal oblique
External abdominal oblique
Iliac crest
Mastoid process
Semispinalis capitis
Spinous process (C7)
Semispinalis thoracis
External intercostals
Multifidus
Quadratus lumborum
Erector spinae (cut)


C1
2
3
4
5
6
7
8
T1
2
3
4
5
6
7
8
9
10
11
12
L1
2
3
4
5
S1
2
3
4
5
C
Cervical enlargement
Lumbar enlargement
Cervical plexus
Brachial plexus
Dura mater
Medullary cone
Cauda equina
Lumbosacral plexus
Cervical nerves
Thoracic nerves
Lumbar nerves
Sacral nerves
Coccygeal nerves

Functional Anatomy of the Spine

- Movements of the spine include flexion, extension, right and left lateral flexion and right and left lateral rotation
  - Minimal movement w/in the thoracic region
- Movement of the spine and muscle contributions
- Superficial and deep musculature functioning and abdominal muscular functioning
  - Flexion and extension
  - Trunk rotation and lateral flexion

Prevention of Injuries to the Spine

- Cervical Spine
  - Muscle Strengthening
    - Muscles of the neck resist hyperflexion, hyperextension and rotational forces
    - Prior to impact the athlete should brace by “bulling” the neck (isometric contraction of neck and shoulder muscles)
    - Varied of exercises can be used to strengthen the neck
  - Range of Motion
    - Must have full ROM to prevent injury
    - Can be improved through stretching

- Using Correct Technique
  - Athletes should be taught and use correct technique to reduce the likelihood of cervical spine injuries
  - Avoid using head as a weapon, diving into shallow water

- Lumbar Spine
  - Avoid Stress
    - Avoid unnecessary stresses and strains of daily living
    - Avoid postures and positions that can cause injury
  - Correction of Biomechanical Abnormalities
    - ATC should establish corrective programs based on athlete's anomalies
    - Basic conditioning should emphasize trunk flexibility
    - Spinal extensor and abdominal musculature strength should be stressed in order to maintain proper alignment

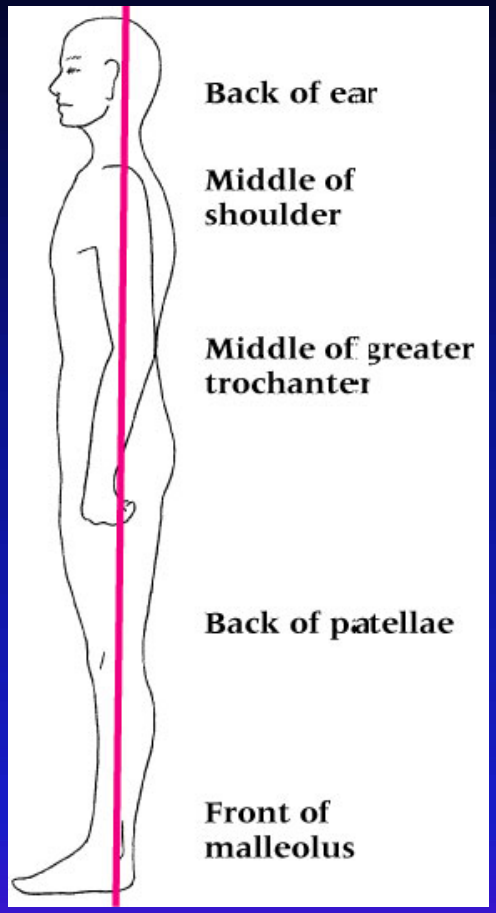
- Using Correct Lifting Techniques
  - Weight lifters can minimize injury of the lumbar spine by using proper technique
  - Incorporation of appropriate breathing techniques can also help to stabilize the spine
  - Weight belts can also be useful in providing added stabilization
  - Use of spotters when lifting
- Core Stabilization
  - Core stabilization, dynamic abdominal bracing and maintaining neutral position can be used to increase lumbopelvic-hip stability
  - Increased stability helps the athlete maintain the spine and pelvis in a comfortable and acceptable mechanical position (prevents microtrauma)

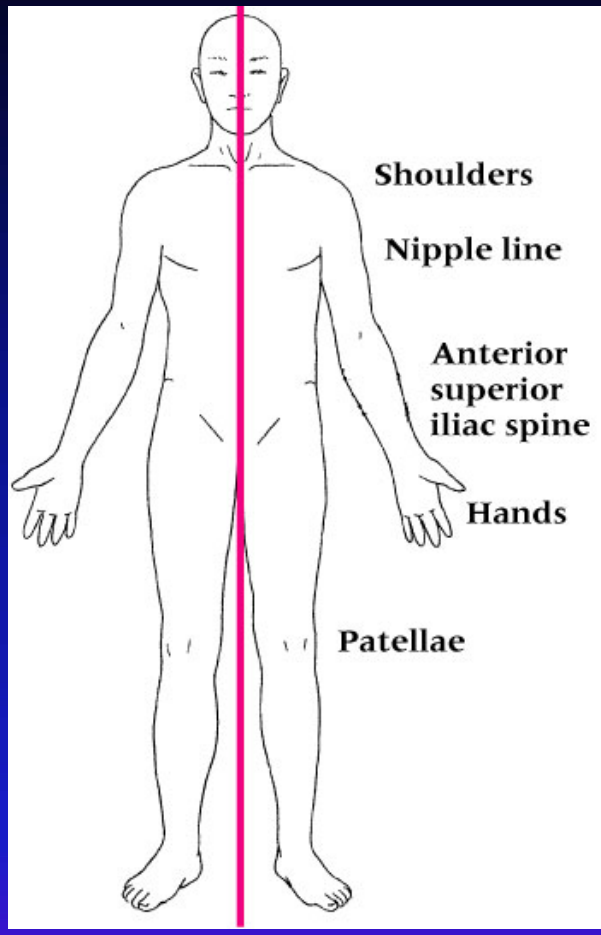
Assessment of the Spine

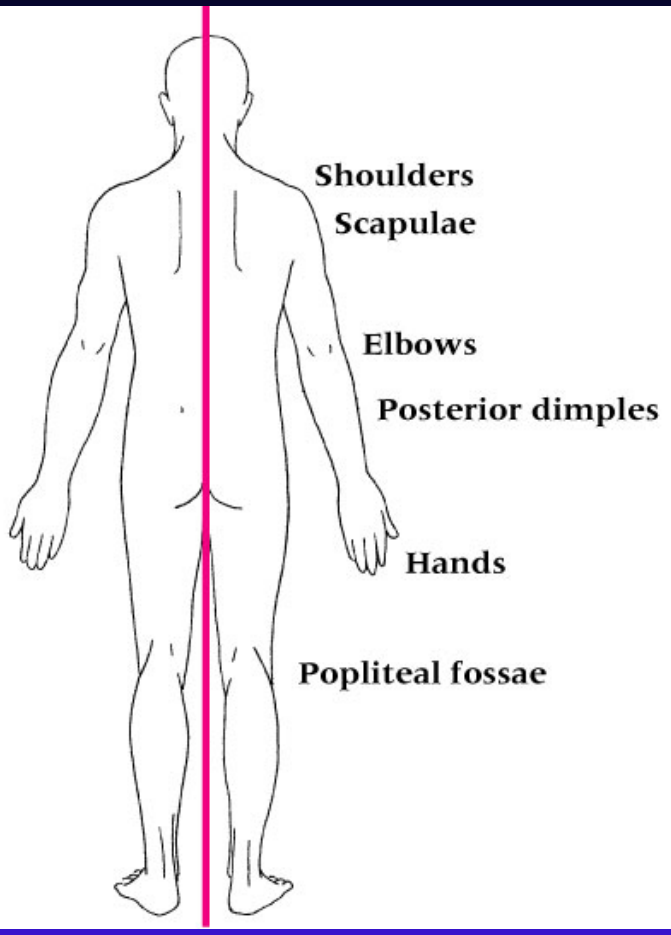
- History
  - Mechanism of injury (rule out spinal cord injury
    - What happened? Did you hit someone or did someone hit you? Did you lose consciousness
    - Pain in your neck? Numbness, tingling, burning?
    - Can you move your ankles and toes?
    - Do you have equal strength in both hands
  - Positive responses to any of these questions will necessitate extreme caution when the athlete is moved

- Other general questions
  - Where is the pain and what kind of pain are you experiencing?
  - What were you doing when the pain started?
  - Did the pain begin immediately and how long have you had it?
  - Positions or movements that increase/decrease pain?
  - Past history of back pain
  - Sleep position and patterns, seated positions and postures

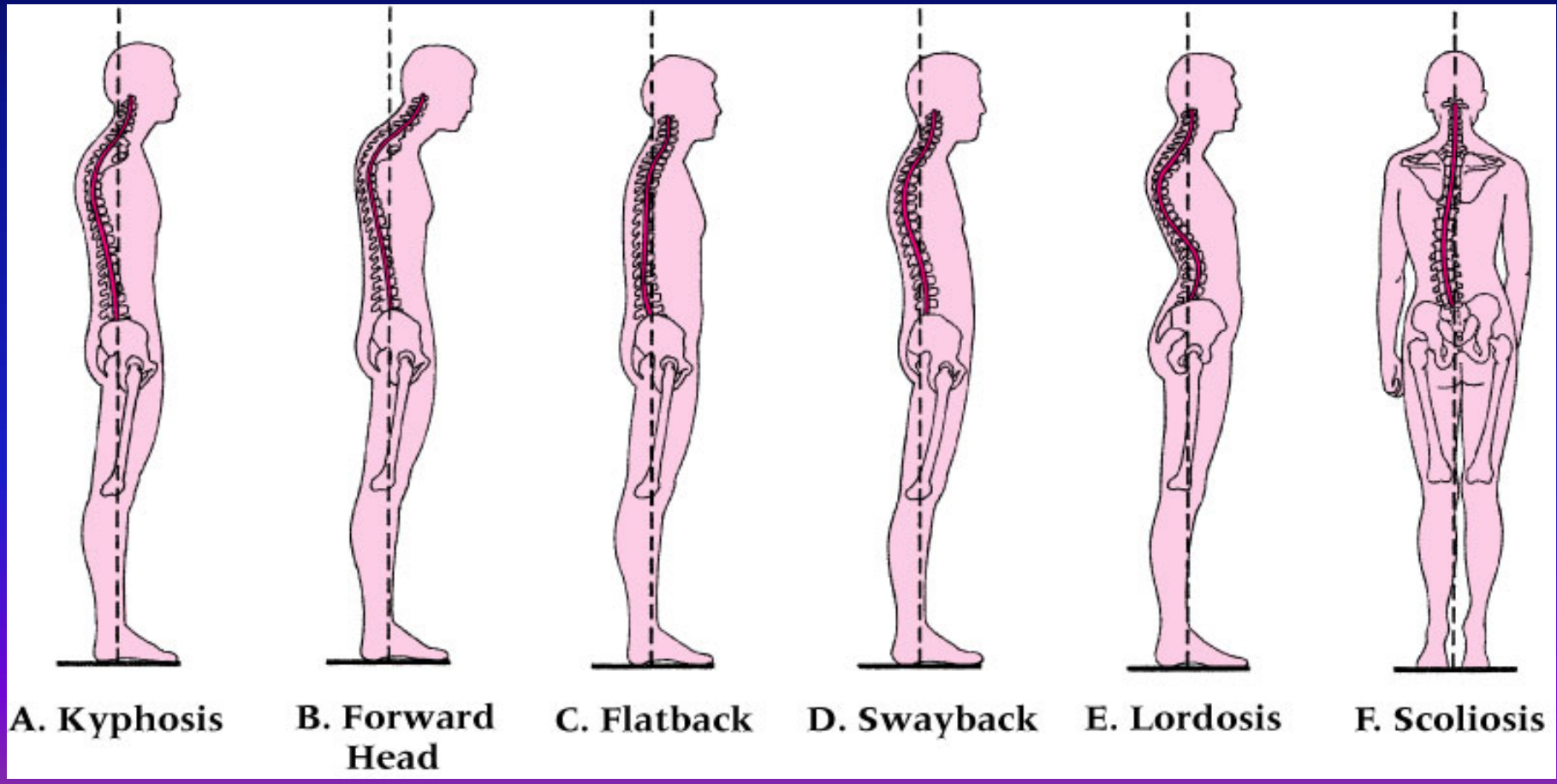
- Observations
  - Body type
  - Postural alignments and asymmetries should be observed from all views
  - Assess height differences between anatomical landmarks


Back of ear
Middle of shoulder
Middle of greater trochanter
Back of patellae
Front of malleolus


Shoulders
Nipple line
Anterior superior iliac spine
Hands
Patellae


Shoulders
Scapulae
Elbows
Posterior dimples
Hands
Popliteal fossae

Postural Malalignments



- Cervical Spine Evaluation
  - Assess position of head and neck
    - Symmetry of shoulders (levels)
    - Will the athlete move the head and neck freely?
    - Assess active, passive and resisted ROM
- Thoracic Spine Evaluation
  - Pain in upper back and scapular region
    - Cervical disk or trigger points (long thoracic nerve or suprascapular nerve involvement)
  - Lower thoracic region pain
  - Facet joint involvement
    - W/ deep inspiration and chin tucked to chest

- Lumbar Spine and Sacroiliac Joint Observations
  - Coordinated movement of the low back involves the pelvis, lumbar spine and sacrum
  - Equal levels (shoulders and hip)
  - Symmetrical soft tissue structures bilaterally
  - Observe athlete seated, standing, supine, side-lying, and prone (leg position - contractures)

- Palpation
  - Spinous processes
    - Spaces between processes - ligamentous or disk related tissue
  - Transverse processes
  - Sacrum and sacroiliac joint
  - Abdominal musculature and spinal musculature
    - Assessing for referred pain
  - Have athlete perform partial sit-up to determine tone and symmetry
  - Assess hip musculature and bony landmarks as well

- Special Tests - Cervical Spine
  - Brachial Plexus Test
    - Application of pressure to head, neck and shoulders to re-create MOI
    - Lateral flexion of the neck w/ same side pain indicates a compression injury
    - Lateral flexion of the neck w/ opposite side pain indicates stretch or traction injury
  - Cervical Compression and Spurling's Test
    - Compression of cervical spine compresses facets and spinal roots
    - Level of pain determines specific nerve root impingement
    - Spurling's adds a rotational component to the cervical compression

- Vertebral Artery Test
  - Athlete is supine
  - ATC extends,laterally bends, and rotates the c-spine in the same direction
  - Dizziness or nystagmus indicates occlusion of the vertebral artery
  - Refer to a physician for testing

- Shoulder Abduction Test
  - Athlete places hand on top of head
  - A decrease in symptoms may indicate the presence of nerve root compression, due possibly to a herniated disk

- Test Done in Standing Position
  - Forward bending
    - Observe movement of PSIS, test posterior spinal ligaments
  - Backward bending
    - Anterior ligaments of the spine
    - Disk problem
  - Side bending
    - Lumbar lesion or sacroiliac dysfunction
  - Standing Trunk Rotation
    - Assessment of symmetrical motions w/out pelvic movement

- Test Done in Sitting Position
  - Forward bending - PSIS motions and restrictions
  - Rotation - lumbar spine motion symmetry
  - Hip Rotation - IR and ER to assess integrity and status of the piriformis muscle
  - “Sign of the Butt” - used to assess potentially serious hip pathology
    - Pain w/ passive ROM, straight leg raise, and hip flexion w/ knee flexion
    - Capsular pattern= limitation of flexion, abduction, internal rotation w/ slight limitations in hip extension and no limitation of external rotation
    - Non-capsular pattern of limitation - gross limitation in all ranges
    - External rotation limitation is the key motion lost in this test

- Slump Test
  - Monitor changes in pain as sequential changes in posture occur
  - 1. Cervical spine flexion
  - 2. Knee extension
  - 3. Ankle dorsiflexion
  - 4. Neck flexion released
  - 5. Both legs extended
  - Assessment of neural tension

- Tests Done in Supine Position
  - Straight Leg Raise
    - 0-30 degrees = hip problem or nerve inflammation
    - 30-60 degrees= sciatic nerve involvement
    - W/ ankle dorsiflexion = nerve root
    - 70-90 degrees = sacroiliac joint pathology
  - Kernig's test
    - Unilateral straight leg raise (lumbar pain into buttocks)
    - Impingement of nerve root due to disk, bony entrapment or irritation of meninges
  - Brudzinkski's test
    - Modified Kernig's w/ neck flexion
    - Lumbar disk or nerve root irritation

– Well Straight Leg Raising Test

- Performed on the unaffected side, may produce pain in the low back on the affected side and cause radiating pain in the sciatic nerve

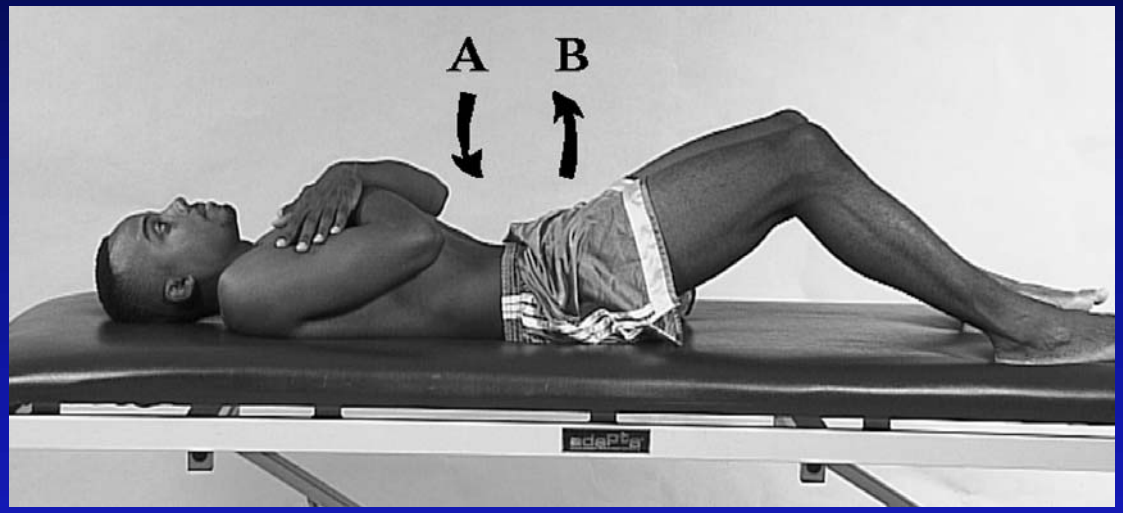
– Milgram and Hoover Straight Leg Raising Test

- Milgram test involves a bilateral straight leg raise that increases intrathecal pressure placing pressure on the disk and nerve roots
- The Hoover test is a variation that utilizes a unilateral straight leg raise

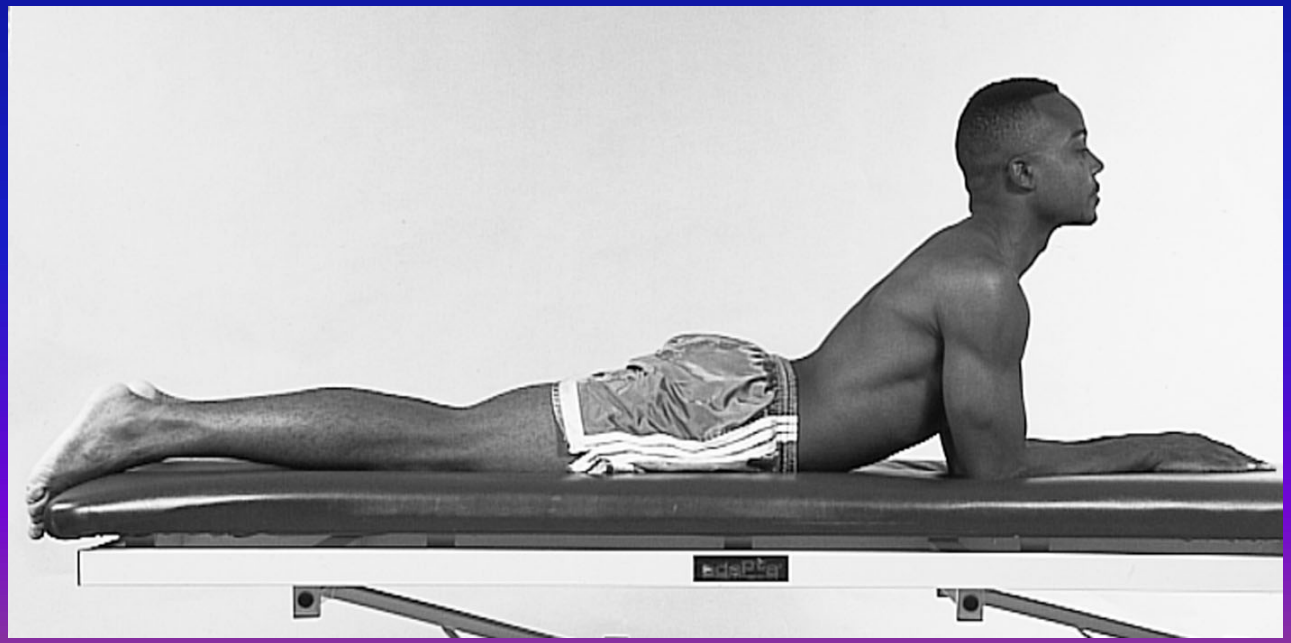
- Bowstring test
  - Used to determine sciatic nerve involvement
  - Leg (on affected side) is lifted until pain is felt
  - Knee is flexed to relieve pressure and popliteal fossa is palpated to elicit pain (along sciatic nerve)
  - To verify problem w/ nerve root, leg is lowered, ankle is dorsiflexed and neck is flexed.
    - Return of pain verifies nerve root pathology
- FABER and FADIR tests
  - FABER or Patrick's test is used to assess hip or SI joint dysfunction
  - FADIR is used to assess problems of the lumbar spine

- Knee to Chest
  - Bilateral - increases symptoms to lumbar spine
  - Single - pain in posterolateral thigh may indicate problem with sacrotuberous ligament
  - Pulling knee to opposite shoulder that produces pain in the PSIS region may indicate sacroiliac ligament irritation
- SI Compression and Distraction Tests
  - Used for pathologies involving SI joint

- Pelvic Tilt Test
  - Anterior and posterior tilts that increase the pain on the side being stressed indicate irritation of the SI joint
  - Can also be performed from side-lying



- Tests Done in Prone Position
  - Press-ups
    - While prone, push up trunk while hips remain fixed to extend the spine
    - Herniated disk would be apparent with radiating pain
    - Localized pain = conservative treatment
    - Generalized pain = surgery may be necessary



- Reverse Straight Leg Raise
  - If pain occurs in low back, an L4 nerve root irritation may be present
- Spring Test
  - Downward pressure is applied through the spinous processes of each vertebrae to assess anterior/posterior motion
  - Can also be performed on transverse processes to assess rotational movement
  - Useful to determine hypomobility or hypermobility of specific vertebral segments

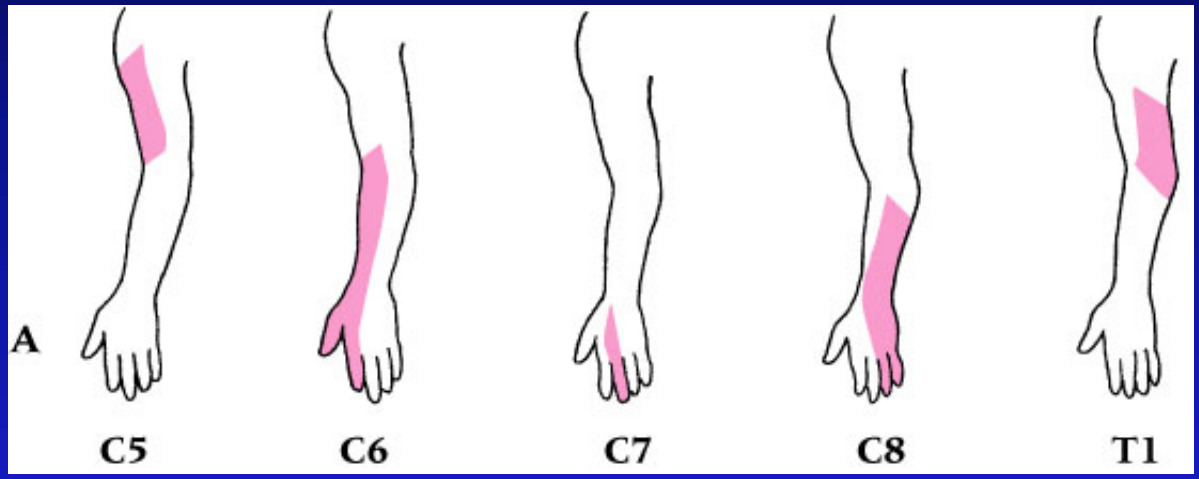
- Prone Knee Flexion Test
  - Comparison of apparent leg lengths w/ athlete prone long-lying and w/ knees flexed to 90 degrees
  - If there is a short side it is indicative of a posteriorly rotated SI joint
  - If upon flexing the knees the lengths equalize, the posteriorly rotated SI joint is indicated

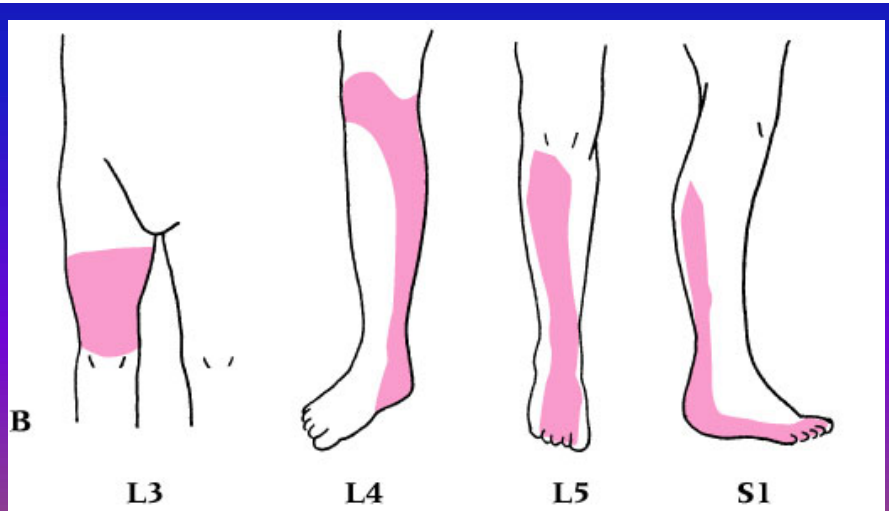
- Tests Done in Side-lying
  - Femoral Nerve Traction Test
    - Hip is extended and knee is flexed to 90 degrees
    - As the hip is extended pain occurs in the anterior thigh = nerve root impingement in the lumbar area
  - Posterior Rotational Stress Test
    - Pain on movement near PSIS indicates irritation of the SI joint
    - Localizes pain to a specific point - does not indicate direction of dysfunction
  - Piriformis Muscle Stretch Test
    - Flexing both hips to 90 degrees and lifting the top leg places the piriformis in a stretched position
    - Increasing pain indicates myofascial pain in that muscle

- Iliotibial Band Stretch Test
  - Test will often provoke pain in the contralateral PSIS area indicating and SI problem
  - SI dysfunction can lead to a shortening of the IT-Band and a perpetuation or reoccurrence of the problem

- Quadratus Lumborum Stretch
  - Use of the pillow opens the upper quadratus to palpation
  - Dropping the leg off the table will provide some stretch to the muscle and possibly provoking pain or demonstrating tightness

- Neurological Exam
  - Sensation Testing
    - If there is nerve root compression, sensation can be disrupted

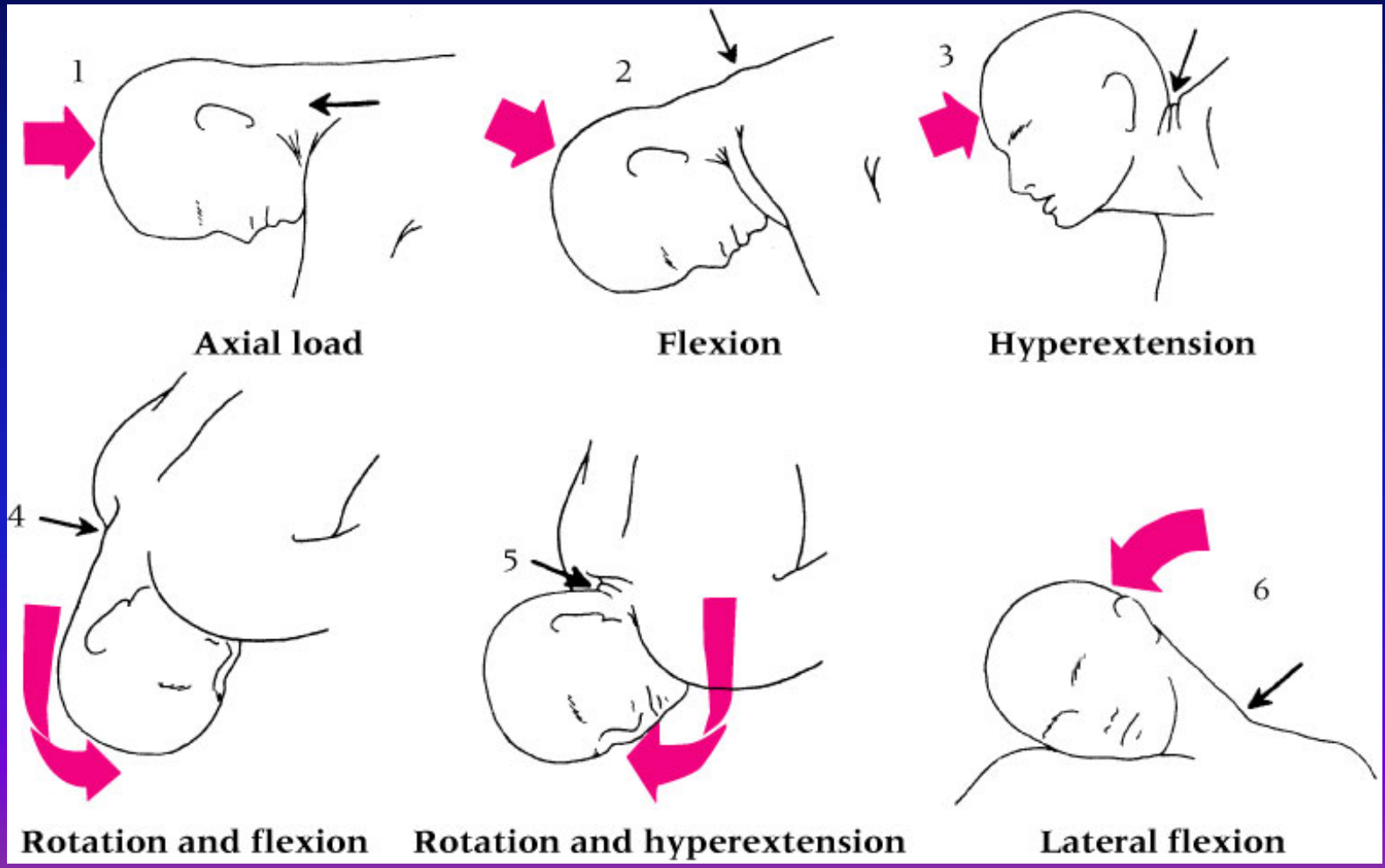




- Reflex Testing
  - Three reflexes in the upper extremity include the biceps, brachioradialis and triceps reflexes
    - Tests C5, C6, and C7 nerve roots respectively
  - The two reflexes to be tested in the lower extremity are the patellar tendon and Achilles tendon reflexes
    - Used to assess the L4 and S1 nerve root respectively

Recognition and Management of Specific Injuries and Conditions

- Cervical Spine Conditions
  - Mechanisms of Injury



- Cervical Fractures
  - Etiology
    - Generally an axial load w/ some degree of cervical flexion
  - Signs and Symptoms
    - Neck point tenderness, restricted motion, cervical muscle spasm, cervical pain, pain in the chest and extremities, numbness in the trunk and or limbs, weakness in the trunk and/or limbs, loss of bladder and bowel control
  - Management
    - Treat like an unconscious athlete until otherwise rule out - use extreme care

- Cervical Dislocation
  - Etiology
    - Usually the result of violent flexion and rotation of the head
  - Signs and Symptoms
    - Considerable pain, numbness, weakness, or paralysis
    - Unilateral dislocation causes the head to be tilted toward the dislocated side with extreme muscle tightness on the elongated side
  - Management
    - Extreme care must be used - more likely to cause spinal cord injury than a fracture

- Acute Strains of the Neck and Upper Back
  - Etiology
    - Sudden turn of the head, forced flexion, extension or rotation
    - Generally involves upper traps, scalenes, splenius capitis and cervicis
  - Signs and Symptoms
    - Localized pain and point tenderness, restricted motion, reluctance to move the neck in any direction
  - Management
    - RICE and application of a cervical collar
    - Follow-up care will involve ROM exercises, isometrics which progress to a full isotonic strengthening program, cryotherapy and superficial thermotherapy, analgesic medications

- Cervical Sprain (Whiplash)
  - Etiology
    - Generally the same mechanism as a strain, just move violent
    - Involves a snapping of the head and neck - compromising the anterior or posterior longitudinal ligament, the interspinous ligament and the supraspinous ligament
  - Signs and Symptoms
    - Similar signs and symptoms to a strain - however, they last longer
    - Tenderness over the transverse and spinous processes
    - Pain will usually arise the day after the trauma (result of muscle spasm)
  - Management
    - Rule out fracture, dislocation, disk injury or cord injury RICE for first 48-72 hours, possibly bed rest if severe enough, analgesics and NSAID's, mechanical traction

- Acute Torticollis (Wryneck)
  - Etiology
    - Pain on one side of the neck upon wakening
    - Result of synovial capsule impingement w/in a facet
  - Signs and Symptoms
    - Palpable point tenderness and muscle spasm, restricted ROM, muscle guarding,
  - Management
    - Variety of techniques including traction, superficial heat and cold treatments, NSAID's
    - Use of a soft collar can be helpful as well

- Cervical Cord and Nerve Root Injuries
  - Etiology
    - Mechanisms include, lacerations, hemorrhage (hematomyelia), contusion and shock
    - Can occur separately or together
  - Signs and Symptoms
    - Various degrees of paralysis impacting motor and sensory function; the level of injury determines the extent of functional deficits
    - Cord lesions at or above C3 result in death, while injury below C4 will allow for some return of nerve root function
    - Incomplete lesions can result in a number of different syndromes and conditions
  - Management
    - Handle w/ extreme caution to minimize further spinal cord damage

- Cervical Spine Stenosis
  - Etiology
    - Syndrome characterized by a narrowing of the spinal canal in the cervical region that impinges on the spinal cord
    - Result of congenital condition or changes in vertebrae (bone spurs, osteophytes or disk bulges
  - Signs and Symptoms
    - Transient quadriplegia may occur from axial loading, hyperflexion/extension
    - Neck pain may be absent initially
    - Sensory and motor deficits occur but generally recover slowly w/in 10-15 minutes
  - Management
    - Extreme caution must be used; Diagnostic testing (X-ray, MRI) must be used to determine extent of problem
    - Participation in sports is generally discouraged

- Brachial Plexus Neurapraxia (Burner)
  - Etiology
    - Result of stretching or compression of the brachial plexus - disrupts peripheral nerve function w/out degenerative changes
  - Signs and Symptoms
    - Burning sensation, numbness and tingling as well as pain extending from the shoulder into the hand
    - Some loss of function of the arm and hand for several minutes
    - Symptoms rarely persist for several days
    - Repeated injury can result in neuritis, muscular atrophy, and permanent damage
  - Management
    - Return to activity once S&S have returned to normal
    - Strengthening and stretching program
    - Padding to limit neck ROM during impact

- Cervical Disk Injuries
  - Etiology
    - Herniation that develops from an extruded posterolateral disk fragment or from degeneration of the disk
    - MOI involves sustained repetitive cervical loading
  - Signs and Symptoms
    - Neck pain w/ some restricted ROM
    - Radicular pain in the upper extremity and associated motor weakness
  - Management
    - Rest and immobilization of the neck to decrease discomfort
    - Neck mobilization and traction to help reduce symptoms and regain motion
    - If conservative treatment is unsuccessful or neurological deficits increase surgery may be needed

Thoracic Spine Conditions

- Scheuermann's Disease (Dorsolumbar Kyphosis)
  - Etiology
    - Result of wedge fractures of 5 degrees or greater in 3 or more consecutive vertebrae w/ disk space abnormalities and irregular epiphyseal endplates
    - Can develop into more serious conditions
  - Signs and Symptoms
    - Kyphosis of the thoracic spine and lumbar lordosis w/out back pain
    - Progresses to point tenderness of the spinous processes; young athlete may complain of backache at the end of a very physically active day
    - Hamstring muscles are characteristically tight
  - Management
    - Prevent progressive kyphosis - work on extension exercises and postural education
    - Bracing, rest, and NSAID's may be helpful
    - Stay active but avoid aggravating movements

Lumbar Spine Conditions

- Low Back Pain
  - Etiology
    - Congenital anomalies
    - Mechanical defects of the spine (posture, obesity and body mechanics)
    - Back trauma
    - Recurrent and chronic low back pain
  - Signs and Symptoms
    - Pain, possible weakness, antalgic gait, propensity to ligamentous sprain, muscle strains and bony defects
    - Neurological signs and symptoms if it becomes disk related
  - Management
    - Correct alignments and body mechanics
    - Strengthening and stretching to ensure proper segmental mechanics

- Lumbar Vertebrae Fracture and Dislocation
  - Etiology
    - Compression fractures or fracture of the spinous or transverse processes
    - Compression fractures are usually the result of trunk hyperflexion or falling from a height
    - Fractures of the processes are generally the result of a direct blow
    - Dislocations tend to be rare
  - Signs and Symptoms
    - Compression fractures will require X-rays for detection
    - Point tenderness over the affected area
    - Palpable defects over the spinous and transverse processes
    - Localized swelling and guarding

- Management
  - X-ray and physician referral
  - Transport with extreme caution and care to minimize movement of the segments

- Low Back Muscle Strain
  - Etiology
    - Sudden extension contraction overload generally in conjunction w/ some type of rotation
    - Chronic strain associated with posture and mechanics
  - Signs and Symptoms
    - Pain may be diffuse or localized; pain w/ active extension and passive flexion
    - No radiating pain distal to the buttocks; no neurological involvement
  - Management
    - RICE to decrease spasm; followed by a graduated stretching and strengthening program
    - Complete bed rest may be necessary if it is severe enough
    - NSAID's

- Myofascial Pain Syndrome
  - Etiology
    - Regional pain with referred pain to a specific area that occurs with pressure or palpation of a tender spot or trigger point w/in a muscle
  - Signs and Symptoms
    - Piriformis - pain in posterior sacroiliac region, into buttocks and down posterior portion of thigh; deep ache that increases w/ exercise or prolonged sitting w/ hip adduction, flexion and medial rotation

- Quadratus lumborum - sharp aching pain in low back, referred to upper buttocks and posterior sacroiliac region and abdominal wall; increased pain with standing, coughing, sneezing and sit to stand motions; pain increases with side bend toward the trigger point

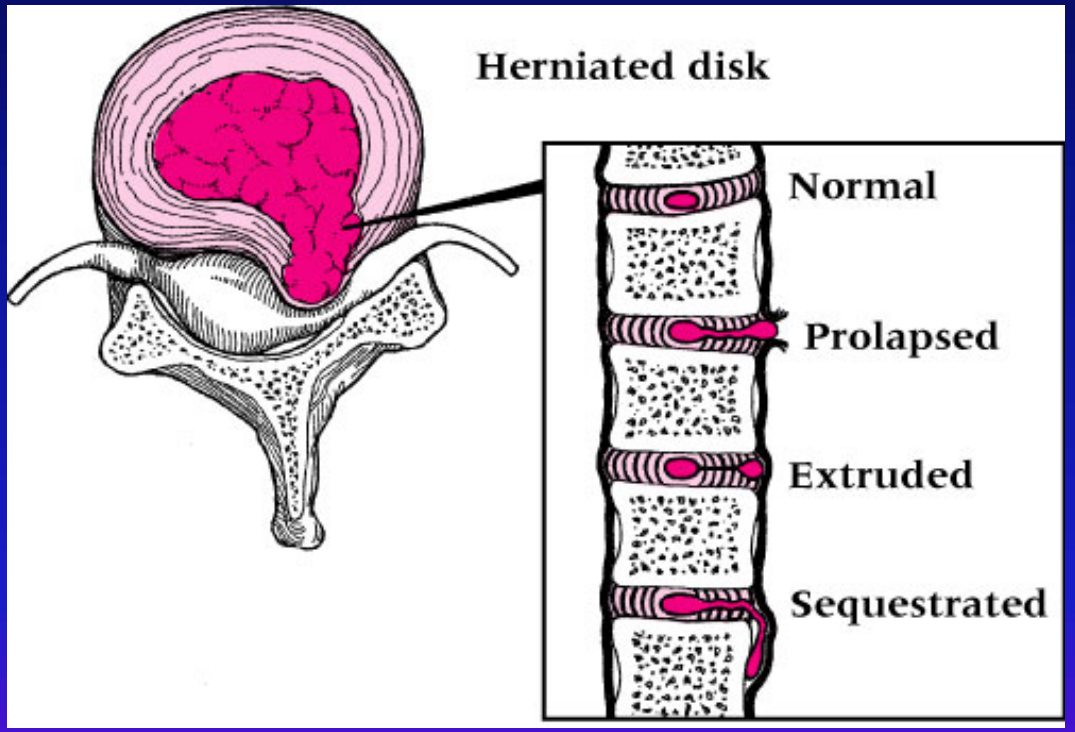
– Management
  - Stretching and strengthening of the involved muscle
  - Return muscle to normal length
  - Electric stimulation and ultrasound can be used to treat discomfort and pain

- Lumbar Strains
  - Etiology
    - Forward bending and twisting can cause injury
    - Chronic or repetitive in nature
  - Signs and Symptoms
    - Localized pain lateral to the spinous process
    - Pain becomes sharper w/ certain movements or postures
    - Passive anteroposterior or rotational movements will increase pain
  - Management
    - RICE, joint mobs, strengthening for abdominals, stretching in all directions
    - Trunk stabilization exercises
    - Braces should be worn early to provide support

- Back Contusions
  - Etiology
    - Significant impact or direct blow to the back
  - Signs and Symptoms
    - Pain, swelling, muscle spasm and point tenderness
  - Management
    - RICE for the first 72 hours
    - Ice massage combined with gradual stretching
    - Recovery generally last 2 days to 2 weeks
    - Ultrasound is effective for deep muscle treatment

- Sciatica
  - Etiology
    - Inflammatory condition of the sciatic nerve
    - Nerve root compression from intervertebral disk protrusion, structural irregularities w/in the intervertebral foramina or tightness of the piriformis muscle
  - Signs and Symptoms
    - Arises abruptly or gradually; produces sharp shooting pain, tingling and numbness
    - Sensitive to palpation while straight leg raises intensify the pain
  - Management
    - Rest is essential acutely
    - Treat the cause of inflammation; traction if disk protrusion is suspected; NSAID's

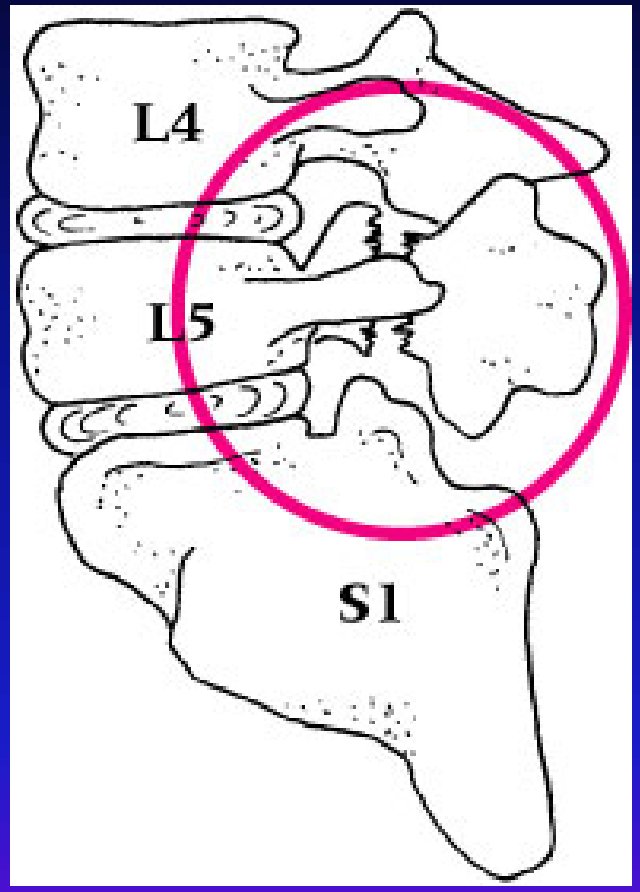
- Herniated Disk
  - Etiology
    - Caused by abnormal stresses and degeneration due to use (forward bending and twisting)



- Signs and Symptoms
  - Centrally located pain that radiate unilaterally in dermatomal pattern
  - Symptoms are worse in the morning
  - Onset is sudden or gradual, pain may increase after the athlete sits and then tries to resume activity
  - Forward bending and sitting increase pain, while back extension reduces pain
  - Straight leg raise to 30 degrees is painful
  - Decreased muscle strength and tendon reflexes; Valsalva maneuver increases pain

- Management
  - Initial treatment should involve pain-reducing modalities (ice and stim)
  - Manual traction and extension exercises to reduce protrusion of disk
  - As pain and posture return to normal additional strengthening exercises can be added
  - If disk is extruded or sequestrated pain modulation is key
  - Flexion exercise and lying supine in a flexed position may help with comfort
  - Surgery may be required

- Spondylolysis and Spondylolisthesis
  - Etiology
    - Spondylolysis refers to degeneration of the vertebrae due to congenital weakness (stress fracture results)
    - Slipping of one vertebrae above or below another is referred to as spondylolisthesis and is often associated with a spondylolysis
  - Signs and Symptoms
    - Spondylolysis begins unilaterally
    - Pain and persistent aching, low back stiffness with increased pain after activity
    - Frequent need to change position
    - Full ROM w/ some hesitation in regards to flexion
    - Localized tenderness and some possible segmental hypermobility
    - Step off deformity may be present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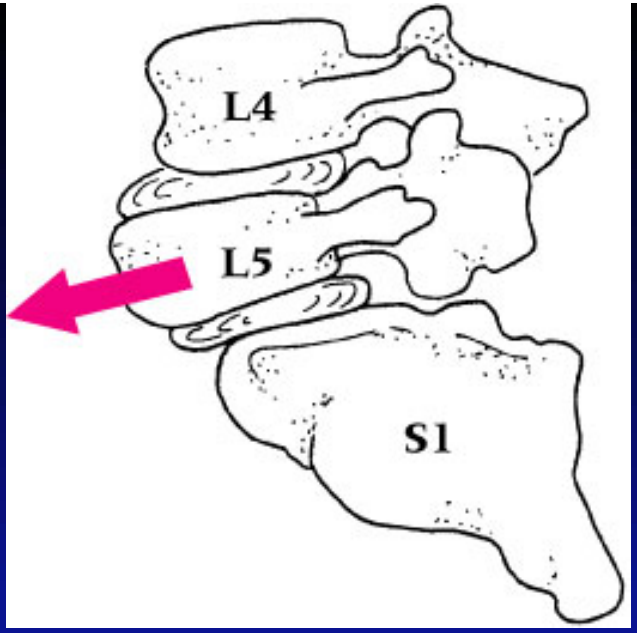
L4
L5
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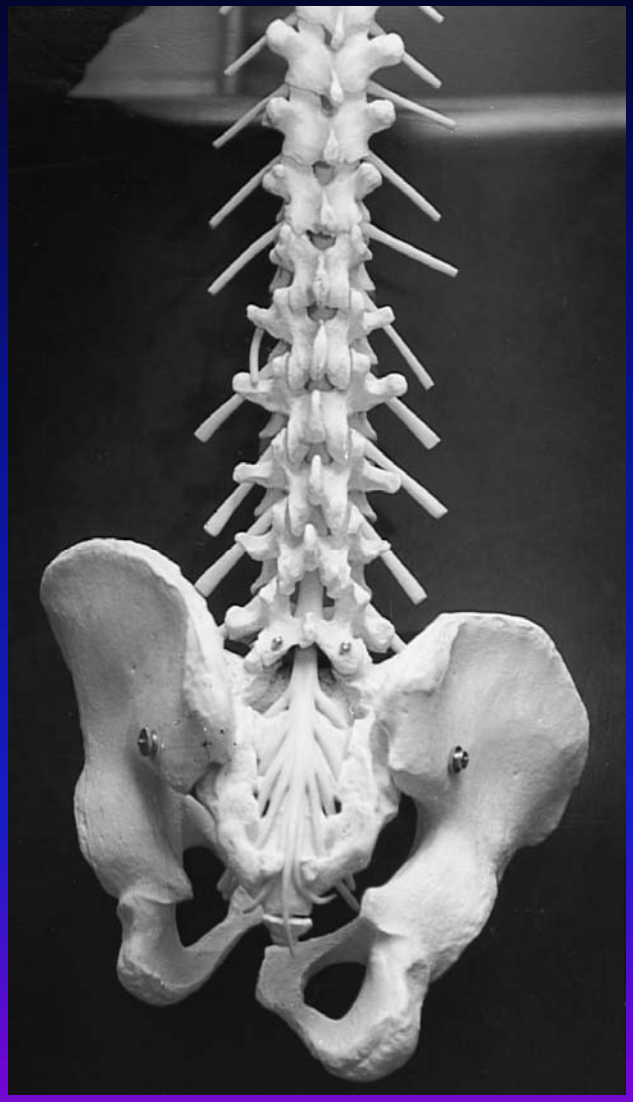
- Management
  - Bracing and occasionally bed rest for 1-3 days will help to reduce pain
  - Major focus should be on exercises directed as controlling or stabilizing hypermobile segments
  - Progressive trunk strengthening, dynamic core strengthening, concentration on abdominal work
  - Braces can also be helpful during high level activities
  - Increased susceptibility to lumbar strains and sprains and thus vigorous activity may need to be limited

Sacroiliac Joint Dysfunction

- Sacroiliac Sprain
  - Etiology
    - Result of twisting with both feet on the ground, stumbles forward, falls backward, steps too far down, heavy landings on one leg, bends forward with knees locked during lifting
    - Causes irritation and stretching of sacrotuberous or sacrospinous ligaments and possible anterior or posterior rotation of innominate bones
    - With pelvic rotation hypomobility is the norm, however, during the healing process hypermobility may result and allow the joint to sublux

- Signs and Symptoms
  - Palpable pain and tenderness over the joint, medial to the PSIS w/ some muscle guarding
  - Pelvic asymmetries, measurable leg length deformities, blocked normal movement during trunk flexion
  - Pain after 45 degrees during the straight leg raise and increased pain during side bending when moving toward the painful side
  - Pain may radiate posteriorly, laterally, or anteriorly down the thigh and may even be vaguely located in the groin
  - Increased pain w/ unilateral stance
  - Movement from sit to stand will create pain
  - Sitting is usually comfortable



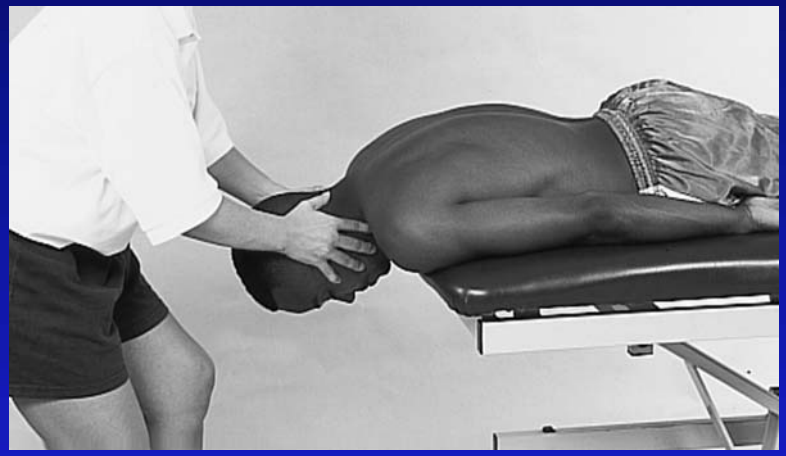
- Management
  - Modalities can be used to reduce pain
  - Bracing can be helpful in acute sprains
  - SI joint must be mobilized to correct positioning
  - Strengthening exercises should be used to stabilize the joints

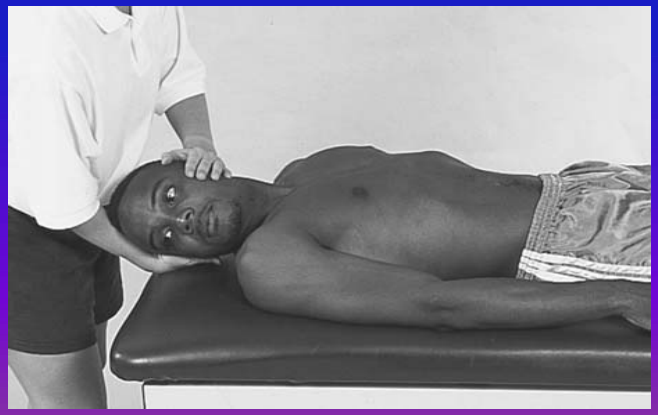
- Coccyx Injuries
  - Etiology
    - Generally the result of a direct impact which may be caused by forcibly sitting down, falling, or being kicked by an opponent
  - Signs and Symptoms
    - Pain is often prolonged and at times chronic
    - May even cause irritation to the coccygeal plexus
  - Management
    - X-rays and rectal exam may be required to determine the extent of the injury
    - Analgesics and a ring seat to relieve pressure while sitting
    - Pain from a fractured coccyx could last months
    - May require protective padding to prevent further injury

Rehabilitation Techniques for the Neck

Joint Mobilizations

- Can be extensively used in rehabilitating the neck for pain reduction, increasing ROM and restoring mobility



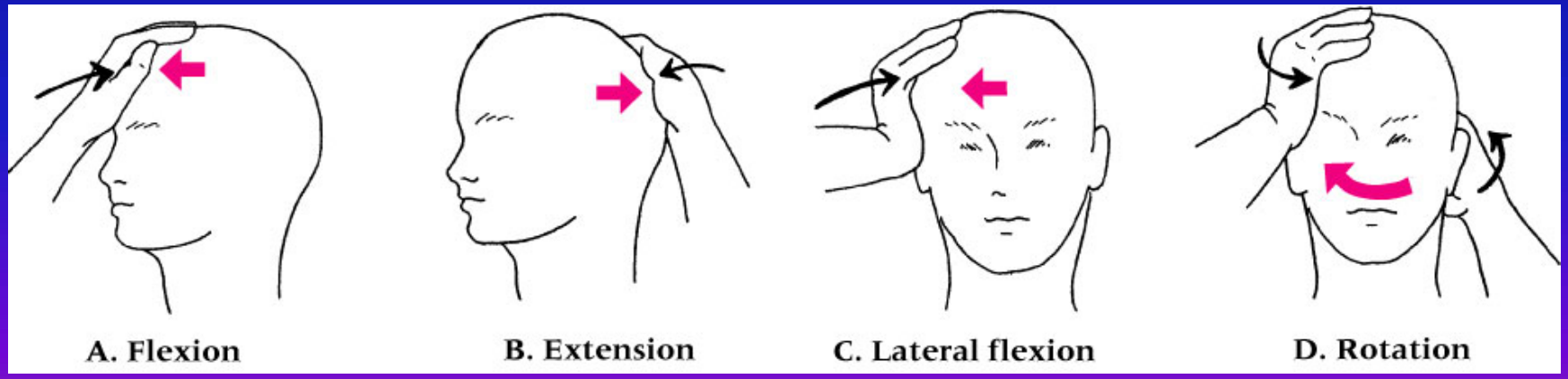


Flexibility Exercises

- Must restore the neck's normal range of motion
- All mobility exercises should be performed pain free
- Perform exercises passively and actively (flexion, extension, lateral bending and rotation)
- Exercises should be performed 2-3 times daily, 8-10 reps and held for at least 6 seconds for each stretch

Strengthening Exercises

- Should be initiated when near normal range has been achieved, and should be performed pain free
- Exercises should progress from isometric to isotonic exercises



Rehabilitation Techniques for the Low Back

- There are a number of philosophical approaches to low back rehab
- Initial treatment should focus on modulating pain (ice, stim, rest; avoid aggravating motions or positions
- Analgesics for pain modulation or muscle relaxants to decrease muscle guarding
- Progressive relaxation techniques

General Body Conditioning

- With acute low back pain, the athlete can be limited for some time
- Activity must be modified during the initial stages
- Resume activity as pain can be tolerated
- Aquatic exercise may be useful to maintain fitness levels

Joint Mobilizations

- Can be used to improve joint mobility or to decrease joint pain by restoring joint accessory motion
- Gradual progression from grade 1 and 2 joint mobs to grades 3 and 4 as pain and muscle guarding subsides
- Should be engaged in, in conjunction w/ manual traction

Traction

- Treatment of choice when there is a small protrusion of the nucleus pulposus
- Distraction of vertebral bodies creates subatmospheric pressure that pulls protrusion back to normal position
- Can be used daily for 2 weeks
- Amount of traction used is a percentage of the patient’s body weight

Flexibility

- There are a variety of exercises that can be performed

Strengthening Exercises

- Should be routinely incorporated into the rehab program
- Used to reinforce pain-reducing movements and postures
- Extension exercises
  - Should be used when pain decreasing w/ lying down and increases w/ sitting
  - Backwards bending is limited but decreases pain -- forward bending increases pain
  - STLR is painful

- Flexion Exercise
  - Used to strengthen abdominals, stretch, extensors and take pressure off nerve roots
  - Pain increases with lying down and decreases with sitting
  - Forward bending decreases pain
  - Lordotic curve does not reverse itself in forward bending
- PNF Exercises
  - Chopping and lifting patterns can be used to strengthen the trunk, re-establish neuromuscular control and proprioception

Neuromuscular Control

- Must re-educate muscles to contract appropriately
- Stabilization exercises can help minimize the cumulative effects of repetitive microtrauma
- Core/dynamic stabilization
  - Control of the pelvis in neutral position
  - Integration full body movements and lumbar control
  - Incorporation of abdominal muscle control is key to lumbar stabilization

Functional Progressions

- Progression of stabilization exercises should move from supine activities, to prone activities, to kneeling and eventually to weight-bearing activities
- Stabilization exercises must be the foundation and should be incorporated into each drill

Return to Activity

- Acute sprains and strains of the back take the same amount of time to heal as most extremity injuries
- With chronic or recurrent injuries, return to full activity can be frustrating and time consuming
- Extensive amounts of time and education concerning skills and techniques of the athlete will be required to achieve a full return to activity