Anatomy of the Spine
E Sacrum and coccyx

- Superior articular process
- Sacral canal
- Median sacral crest
- Auricular surface
- Lateral sacral crest
- Posterior sacral foramina
- Sacral hiatus
- Cornu of coccyx
- Transverse process
- Coccyx
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
Postural Malalignments

A. Kyphosis  B. Forward Head  C. Flatback  D. Swayback  E. Lordosis  F. Scoliosis
• 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
  • With 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

  – **Brudzinski’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 with 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 within 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
– 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 sacrotuberosus 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