MOVEMENT SYSTEM SYNDROMES OF THE LUMBAR SPINE AND HIP: RELATIONSHIPS & INTERACTIONS

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4 Goals for the Profession

- Recognition of movement system
  - Profession, other professionals, public
- Development and use of movement system diagnostic categories – syndromes
  - Diagnostic manuals – like other health professions
- Birth to death practitioners
- Exercise experts – recognition of multi-segment interactions

Movement System: Definition

- Physiological system that functions to produce motion of the body as a whole or of the component parts
- The functional interaction of structures that contribute to the act of moving
  - Steadman's dictionary

Movement System

Movement System Impairment (MSI) Syndromes

- Impairment level of the organism
  - Any abnormality of anatomical, physiological or psychological function.
- Syndromes
  - Collection of impairments based on observable abnormalities, primarily kinesiological, and their relationship to symptoms
    - Correction decreases or eliminates the symptoms
    - Named for principal impairment – the movement direction most consistently affecting the symptoms
    - Other impairments are contributing factors

MSS Assumptions

- LBP is associated with movement in a specific direction
  - Subgroups can be identified
- Repeated movements (RMs) & prolong postures (PPs)
  - Cause development of joint’s directional susceptibility to movement (DSM)
  - Induce tissue changes contributing to development of relative flexibility (the body takes the path of least resistance for movement) > DSM
- Tissue changes include neuromusculoskeletal
  - Combined with biomechanical interactions.
  - The DSM is associated with accessory motion hypermobility the cause of tissue injury & degeneration
- Musculoskeletal pain is a progressive condition associated with degenerative changes and is affected by lifestyle

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Movement System Impairment
Syndromes of the Low Back

Question 1: What is the critical change in the spine?
Question 2: How much does the hip contribute?
Question 3: How to differentiate whether the pain is from the low back, the hip, both?

What is the critical change in the lumbar spine?
- Tissue adaptations from repeated movements and sustained alignments
- Result in hypermobility
  - primarily accessory / arthrokinematic motion
- Characterized by relative flexibility / relative stiffness
- Direction specific
- Body takes the path of least resistance for motion

How much does the hip contribute?

Muscular factors – affect low back

Muscular
- Lumbar Rotation
  - hip rotators, abductors
  - L Flexion
  - Hip extensors
  - L Extension
  - Hip flexors

Structural
- Lumbar Rotation
  - Femoral anteversion / retroversion
- L Flexion
  - Cam impingement
  - Pincer impingement
  - L Extension

Pain in the hip region - what is the Source?

Low back
Hip
Both the low back and the hip

Meralgia paresthetica
Pain from spine 
hip joint 
muscle strain

Low back vs S1
Pain from spine 
piriformis synd
sciatric notch synd
sciatica – spine
hamstring strain

Greater trochanter pain syndrome
bursitis, ITB fascitis
Cumulative Trauma

- Exceeding tissue tolerance
  - Load increase
  - Tolerance decrease
- Materials fatigue during repetitive loading
  - Causes damage
  - For example: repeated bending
- Personal factors are part of influences
  - Aging, conditioning, genetics, lifestyle habits, psychological state, personality, current state of tissue degeneration – change over time
  - Adams M & Dalton P= book and Papers

Differentiation

1. A thorough movement exam of both the low back and hip that includes their interactions.
2. Identifying the joint or segment, whose movement causes the symptom, and when stabilized, reduces or eliminates the symptoms
   - Movement of the joint itself
   - Movement of the limbs as they affect the spine
3. Knowledge of syndromes of lumbar spine & hip

The Syndromes

- Lumbar spine
  - Extension: extension-rotation
  - Flexion: flexion-rotation
  - Rotation: primary & secondary
- Hip
  - Femoral - 50% structural
    - Anterior glide with medial or lateral rotation
    - Posterior glide with medial rotation
    - Multidirectional accessory hypermobility
    - Hypomobility with superior glide

Key Concepts I

- Path of least resistance for motion
- Relative Flexibility
  - Intrinsic motion segment mobility
  - Muscle passive stiffness
- Hypermobility causes the pain
  - Accessory motion
  - Range & frequency
  - What moves is what hurts

Key Concepts II

- The way everyday activities are performed is the critical issue
  - Repeated movements and Sustained alignments

Key Concepts III

- You get what you train (many strategies to create moments at a joint or within a limb)
- Presence of a muscle does not mean appropriate use
- No magic in an exercise except if the desired motion is evident

Does strengthening the serratus improve scapular upward rotation?
**Life Span Practitioner**

- Monitoring and Guiding the development of the Movement System
  - Alignment, movement patterns, strength, endurance
  - Identifying structural variations

**Movement System Impairment Syndromes**

- Identify the cause of the dysfunction
- Identify the contributing factors
- Organize specific tissue impairments
  - Minimizing treatment of isolated impairments
    - Usually limited in effectiveness
- Provide a direction for intervention
  - do not require identification of a specific pathoanatomical structure (source)
- Based on anatomy and kinesiology

**Lumbar Flexion Syndromes**

- Young – Tall – Acute

**Case Presentation: low back pain - flexion**

- Demographics:
  - 40 year old male
  - 6 feet tall
- Complaint: LBP sitting>standing
- Occupation: Executive
- Leisure-time activity: ultramarathonist

- Kendall: Muscles Testing & Function 1983

**Patient-Preferred Movement**

- Lumbar flexion > hip flexion
- Posterior shift of hips
- Hyperextension of knees
- Increased LBP

- What is his natural unsupported sitting alignment?
Patient-preferred sitting; Lumbar flexion

Patient-preferred movement knee extension; Increased lumbar flexion

Patient-Preferred Alignment

Lumbar spine flexed
Hips < 90 degrees

Short abdominal muscles
Relaxed standing
Erect standing

Case Presentation: Low Back Pain – flexion
Young – tall – flexible: student/diver
sit-up exercises
Hip extensors not short
Relative flexibility: abdominals > hip extensors > back ext

Abdominals strong
Back extensors more flexible than the hip extensors

Lumbar Flexion Syndrome

Case Presentation: LBP -DDD

64 YO

Standing Alignment

DDD of entire lumbar spine:
Having chronic pain and acute episodes
**Quadruped Rocking**

Doing all the wrong exercises

**Immediate change post quadruped**

Pre

Immediate Post

**Kinesiopathological Model Of Human Movement System**

Base

Muscle

Modulator

Muscle

Support

Cardio/pulmonary

Metabolic

Inducers

Repetitive movements

Sustained alignments

Motor Performance

Tissue adaptations

Muscular, neuro, skeletal

**Lumbar Extension Syndromes**

Old – short – chronic

Variation in contributing factors

**Patients with Low Back Pain**

**Case Presentation: Low Back Pain**

- What was her sport
- Why does she stand in this alignment?
- Why is she standing with her trunk swayed back?
- Are her hip flexors short?

**Abdominal vs hip flexor stiffness**
Case Presentation: Low back pain

General Joint hypermobility
Lumbar Extension

Initial Visit
Two Weeks Later
Abdominals too short contributing to kyphosis and swayed back posture
rectus abdominis anti-gravity muscle

Lumbar Extension Syndrome

Case Presentation: low back pain

Two Joint Hip flexor test

Lumbar Extension Syndrome

The MSI Examination

- **Purpose:** assess symptoms and relationship to
  - Alignment and movement; movement pattern
  - Of the trunk and of the extremities and how they affect the spine
  - Preferred (natural movement) & corrected movement
  - Biomechanically linked system, therefore movement at one segment affects other segments, particularly adjoining segments
- **Format:** standing; supine, sidelying, prone, quadruped, sitting, walking

The Examination

- **Standing:** Sx, position; alignment; forward bending; return; sidebending; rotation; single-leg standing
- **Supine:** position; Hip flexor length; pass&act hip/knee flexion; hip abd/lat rot;
- **Sidelying:** position; hip lat rot; hip abd
- **Prone:** position, knee flex; hip rot
- **Quadruped:** position; rocking back; shoulder flex
- **Sitting:** knee ext
- **Standing:** back to wall
- **Gait:**

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Lumbar Rotation Syndromes

Pain side bending, rotating, flex & ext
Signs and not symptoms
Types: primary & secondary

Patient with Low Back Pain

Observe her pelvis while walking; note structural characteristic of hips

Alignment

Rotation

Side Ilying Hip Lateral Rotation (L)

Side Ilying Hip Abduction (L)
**Prone Knee Flexion**

![Prone Knee Flexion Image]

Muscles in series and in parallel

Passive stretch of stiff & < stiff muscle in series

**Prone Hip Rotation**

![Prone Hip Rotation Image]

**Walking – Corrected**

![Walking Image]

**Muscle Stiffness = Passive Tension**

- Change in tension/unit change in length
  - Normal property
- Degree of tension during passive stretch
  - Correlated to size of muscle
- Source: Titin (connectin)
  - Large intracellular connective tissue protein

**Source of Muscle Stiffness: Titin**

Large Intracellular Protein

Attaches myosin to Z-line; 6/myosin
Passive Stiffness of Elbow Flexors: Men & Women

Correlation: Muscle Volume & Stiffness

Relative Flexibility

- Spinal Hypermobility/Instability
- Imbalanced Relative Muscle Stiffness

Accessory Motion Hypermobility

- Evident when vertebral joint moves readily during motion that should be occurring at another joint
  - For example at the hip joint.

Starting position of ASIS
Immediate Anterior Pelvic Tilt with hip extension
Cannot be muscle shortness

Relative Stiffness – Relative Flexibility

Pelvic Anterior Tilt
- Pull from hip flexors is greater than stiffness of lumbopelvic region & Spinal stability

No Pelvic Tilt
- Abdominal muscles and lumbar spine stiffer than tension from elongation of hip flexors

Relative Flexibility (RF) is Key Factor

- Definition
  - RF is readily elicited impaired spinal motion – usually accessory motion hypermobility

- Result of
  - 1) Intrinsic spinal hypermobility
    - Ligament laxity, loss of disc height, “neutral zone” enlargement
  - 2) Imbalance of relative stiffness of muscles about the joint
    - Passive tension with elongation of one muscle not counterbalanced by stiffness of stabilizing muscle
Spinal Hypermobility/Instability

Definition

Pertinent Literature

Overview of Washington Univ VanDillen Studies

Spinal Hypermobility/Instability

- Degenerative instability –
  - Back pain exacerbated by movement and associated with inter-segmental movements that are abnormal or excessive at one or more spinal levels.

- Enlargement of the “neutral zone”.
  - Neutral zone = region of spine with minimal internal resistance to movement – can “wobble freely”
  - Becomes enlarged with spinal instability

- Characteristics
  - Increases with age
  - Sensitive indicator of minor injury
  - Hypothesized to be related to clinical instability
  - Defined as reduced stiffness (resistance to movement)


Spinal Hypermobility/Instability

Sources of Passive Muscle Stiffness

- Structural proteins
  - Titin,
  - Extracellular matrix – endomysium, perimysium, epimysium

- Collagen – whole muscle

- Weak binding of actin & myosin (thixotropy)

- Tendon

Muscle Active & Passive Tension

Implications of relationship

- Hypertrophy of muscle increases the passive tension
- Passive tension provides “control” of segments
- Reduces demands for active tension for “control”
- Requires optimal length and relative tension
- Immediate delivery of tension to attachment at active contraction

Muscle Length

- Muscles maintained in lengthened position
  - Add sarcomeres in series
  - Shifts length-tension curve to right
  - Test “weak” at short length (at end of range and not through the range)
Sarcomere Adaptation

- Sarcomeres of each muscle are programmed to maintain a particular length as measured from Z line to Z line.
- The resting length of the sarcomeres in a given muscle may be in the region of the ascending limb of the length-tension curve (a or b), descending limb (d) or at optimal length (c).
- The sarcomere length corresponds with that muscle's functional abilities.

Sarcomere Adaptation

Potential implications for muscle length

- In animal models, prolonged immobilization of muscle in
  - A lengthened position resulted in the muscle adding sarcomeres in series
  - A shortened position caused the muscle to lose sarcomeres in series
  - So the sarcomeres adapt by changing number to return to the appropriate sarcomere length for that muscle
- Mechanism responsible for sarcomere addition/subtraction is not known
- Presumed that human muscles have similar capacity however the exact dosage of stimulus required to produce change in sarcomere number is unknown
- How much length change has to occur? Over what period of time?

Tested In Shortened Position

Lengthened
Control

2.4 microns - sarcomere set-point
7 sarcomeres in series
Normal - ideal

11 sarcomeres in series
Lengthened
Long muscle adds sarcomeres in series - alters length tension curve

Kinesiopathologic Model of Movement System

Muscular - Skeletal
Nervous
Cardio - pulmonary
Metabolism

Biomechanics

Inducers:
- Repeated movements
- Sustained alignments
- Imbalanced Muscle
- Relative Stiffness
- Increased spine mobility
- Lig. laxity, loss of disk height, "neutral zone"

Relative Flexibility

Modifiers:
- Personal Characteristics
- Spinal Accessory Hypersensitivity

Lumbar Rotation

Extension and Flexion
Lumbar Rotation – flexion & extension

Corrected by allowing the back to flatten and using the overlap of the facet joints to decrease the rotation.

Rotation - Primary

Herniated disc scheduled for surgery
Has pain when rotated

Rotated Spine
Increases when rocking backward

Hip flexion limited – most likely structural

Treatment Effect

Before
After quadraped rocking

Case Presentation: Low back pain with left radiculopathy
6 months post-partum - twins

Initial visit
5 days later
Successive Visits

Rotation to left when rocking back

Natural standing: Right foot on footstool

Right iliospsoas pulling > Left iliospsoas

Summary of Evidence

- Clinical Exam:
  - reliability – tests of trunk and limb movements
  - Valid for classifying subgroups of low back patients
  - Modification of trunk & limb movements decrease or eliminate symptoms
- Relative Stiffness / Flexibility
  - Knee flexion, hip lateral rotation & trunk lateral bending, passive elastic stiffness of trunk
  - Cause earlier lumbopelvic motion in LBP vs No LBP
  - Have a relationship to subcategories of LBP
- NOT the length of muscles
  - IS the relative stiffness of the spine

Summary Consistent With Evidence

- Low back pain (musculoskeletal pain syndromes) are from cumulative trauma
  - Progressive changes in tissue from repeated movements and prolonged postures
  - Multifactorial
- Classification according to painful movement direction is consistent with
  - A joint's directional susceptibility to movement (DSM)
  - Moves more readily in a specific direction than other joints that move in that same direction
- Treatment should be
  - Based on movement system diagnosis
  - Directed toward predisposing and contributing factors
  - Address contributing factors to slow or prevent recurrences (progressive degeneration)
  - Movement patterns associated with all activities
  - Specific exercises
  - Hypermobility of accessory motion underlying cause of degeneration

Treatment Strategy

- Current recommendation
  - During an activity
    - Train to decrease lumbar region motion while increasing movement in other regions
  - Validation – Did the symptoms improve?
  - Training which segments are contributing, how much and when they are contributing
## How?

- **Dependent on contributing factors**
  - Neural control –
    - Motor Pattern Incoordination
  - Musculoskeletal ↔ Neural control
    - Consideration - are musculoskeletal factors modifiable or not, i.e., increasing risk?
    - Force Production Deficit

- **Priority**
  - Decrease lumbar region motion *(accessory motion hypermobility)*
  - Increase motion of relatively stiffer segments

- Incorporate training into specific everyday movements
### Movement System Impairment Syndromes of the Hip

**Name_________________     M  F       Height _____   Weight ____  Age _____**

**Occupation ________________      Fitness Activity ______________________**

**Structural characteristics ___________________________________________**

**Pain Location:**

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### Movement System Impairment Syndromes of the Hip

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GAIT

Pain in groin                                Hip
Hip drop / lateral trunk flexion             Hip
Hip medial rotation                          Hip
Pelvic rotation excessive                    Hip
Knee hyperextension/limited heel rise        Hip

Diagnosis for Physical Therapy: flexion; extension; rotation; rotation-extension; rotation-flexion
femoral: anterior glide medial rotation lateral rotation posterior glide; accessory hypermobility; hypomobility with superior glide
Hip: adduction; medial rotation; lateral rotation

Contributing Factors:

Functional Activities needing modification

Walking
Standing
Sitting
Recumbent Position
Rolling
Work arrangement
Recreational/fitness Activities

Symptom modification activities

Contract abdominals
Back against wall
Sitting
Quadruped
Recumbent: supine prone
### Movement System Impairment Syndromes: Sahrmann & Associates

**Name_________________**  **M  F**  **Hgt_____ Weight ____  Age _____ Date ____

**Occupation ________________**  **Fitness Activity ______________________**

**Structural characteristics ___________________________________________**

**Pain Location: _____________________________________________________**

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**Total**

**Comments:**

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54  Movement System Impairment Syndromes: Sahrmann & Associates
## Movement System Impairment Syndromes of the Low Back

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Comments:
Movement System Impairment Syndromes of the Low Back

Diagnosis for Physical Therapy: flexion; extension; rotation; rotation-extension; rotation-flexion

Contributing Factors:

Functional Activities needing modification

Walking
Standing
Sitting

Recumbent Position
Rolling

Work arrangement

Recreational/fitness Activities

Symptom modification activities

Contract abdominals
Back against wall
Sitting
Quadruped
Recumbent: supine prone

Key exercises
LOWER QUARTER EXAMINATION
(* key test for low back diagnosis)

A. STANDING:
1. Appearance (size, structural proportions)
2. Alignment
3. Forward bending: corrected forward bending *
4. Return from forward bending: corrected return from forward bending *
5. Sidebending; corrected sidebending *
6. Rotation *
7. Backbending *
8. Single leg stance
9. Hip and knee flexion (partial squat) (LE)

B. SITTING:
1. Alignment (corrected vs. flexed or extended)*
2. Knee extension with dorsiflexion
3. Hip flexion (iliopsoas) muscle performance (LE)
4. Hip rotation (muscle performance and ROM) (LE)

C. SUPINE:
1. Bilateral hip and knee flexion (passive) *
2. Hip flexor length test
3. Position of hips and knees extended vs. hips and knees flexed *
4. Unilateral hip and knee flexion (passive and active)
5. Hip abduction/lateral rotation from flexion *
6. Lower abdominal muscle performance
7. Upper abdominal muscle performance (Optional)
8. SLR (passive and active)
9. Iliopsoas muscle performance (LE)
10. TFL-ITB muscle performance (LE)

D. SIDELYING:
1. Position
2. Hip lateral rotation/abduction
3. Hip abduction
4. Hip adduction (top LE and bottom LE)
5. Modified Ober (LE)
6. Hip abd/LR/ext (post. gluteus med.) muscle performance

E. PRONE:
1. Position (pillow vs. no pillow) *
2. Knee flexion *
3. Hip rotation *
4. Hip extension with knee extended *
5. Hip extension with the knee flexed (Gluteus Maximus) muscle performance

F. QUADRUPED:
1. Alignment (preferred vs. corrected)
2. Rocking backward *
3. Rocking forward *
4. Shoulder flexion *

G. STANDING WITH BACK TO WALL:
1. Flatten back *
2. Shoulder flexion

H. BASIC MOBILITY
1. Rolling
2. Supine to sit
3. Sit to stand
4. Gait
4. Stairs
5. Positions or movements specific to job or sport

12/31/03
TREATMENT SUGGESTIONS FOR PATIENTS WITH LOW BACK SYNDROMES
Developed by Shirley A. Sahrmann, PT, PhD, FAPTA

General Comments:

1. The major guide to expected success in outcome is if the pain can be modified by correcting the movement and the consistency of the pattern of pain.

2. After classifying the patient, i.e., flexion, extension, rotation, try to identify what activities of daily living or positions involve that movement.

3. Be sure the patient understands what you believe is the direction susceptible to movement and how that contributes to his/her pain.

4. The results of tests guide exercise selection.

5. Make a special effort to emphasize exercises, postural alignment, or positions that can be incorporated into their everyday movements. For example, if they experience pain when standing and it is eliminated by contracting their abdominals, make sure they understand and practice that many times before leaving the clinic. Have them stand and talk with you, if they show expressions of pain, remind them to contract abdominals and make sure the pain is diminished.

6. The patient should understand and know how they are in charge of their pain and that they know what movements elicit it, how to control or diminish it.

7. Make sure the patient understands that isometric exercises used for pain control are really therapeutic and are changing muscle performance and are not just a temporary pain intervention. “The less pain, the less the tissue irritation, the more the correction of the mechanical cause of the tissue irritation.”

8. The highest priority for the therapeutic program is to address the positions and movements that cause pain. For example, if the patient says they cannot sit without pain, have them sit and change the alignment of their lumbar spine and/or the position of their legs until it is clear what increases and decreases their pain. This is usually easier to do after the exam when you have a diagnostic category in mind and knowledge of the contributing factors. If you are trying to verify a working hypothesis and can use the sitting factors to support your hypothesis this is also useful. If the patient has pain going from sit to stand, doing stairs, rolling, sitting up from supine, be sure to practice all these activities until methods are established that eliminate or minimize the pain.

9. Use the standards for normal range of motion as a guide as to whether patients should improve their spinal flexibility. Remember one of the challenges is to be sure that the movement is occurring at the appropriate segments, not at the segment that is already too flexible.
10. Rotation is the most common movement direction that contributes to low back syndrome. Be sure your patient has identified any activities that he may perform that cause rotation. Those particularly susceptible are patients who sit and then rotate just managing things on their desk.

11. Be sure to review any exercises or fitness activities that patients may be doing on their own. Often they are doing things that contribute to what you are working hard to correct.

12. Soft abdominal binders are often helpful in patients with stenosis and extension syndromes if they have a protruding abdomen. If they are very obese, the binder is usually too uncomfortable or interferes with breathing.

13. Rolling in one piece without pushing with feet is a very good exercise for abdominals, particularly for the obese and the elderly. Be sure they have a wide bed so they can roll without trying to stay in one spot or without worrying of falling off.

GERIATRIC PATIENTS

14. Great care should be used in recommending any type of lumbar extension exercises in patients 65 years or older. Stenosis and disc narrowing reduce the area of the intervertebral foramina putting the patient at risk for radiculopathy with any exercises that narrow the intervertebral foramina, such as lumbar extension exercises or hip extension exercises.

15. Tightening the buttocks posteriorly tilts the pelvis and only INDIRECTLY flattens the lumbar spine. If there is resistance to lumbar flexion because of bony changes, the gluteal set may cause shearing between L5 and S1. If the patient gets radiation with gluteal sets this may be the reason. Tightening the abdominals exerts a flexion force throughout the entire lumbar spine.

16. For most of the older geriatric patients, I do not use hands and knees which is hard on the HEART, neck, and wrists. The major effort should be in basic mobility activities and how to move in bed and to move their lower extremities in bed without pain.

17. Many geriatric patients believe standing up straight is pulling your shoulders back. In the process of doing that, they increase their lumbar extension and do not contract their abdominals.

SITTING CONSIDERATIONS

18. Patients with a kyphosis usually have extension stress because they extend their lumbar spine to compensate for the thoracic curve or they sway their upper back backward. These patients may have pain with sitting because they actually sit in extension rather than in flexion. A support behind their back helps reduce the load on the lumbar spine.

19. Patients should have a support behind their entire lumbar spine and the shoulders should be over their hip joints. If the shoulders are behind the hips, it will contribute to an extension moment on the spine. When the shoulders are in front of the hips, it contributes to a flexion moment on the spine.
20. Watch how people get up from the back of a chair. A common problem is scooting forward with one hip at a time, which causes rotation. The patient should move forward in the chair and move in one piece.

21. When standing up from the chair, it is often better for alignment to push up from their thighs than the armrests. If they hold onto the armrests for too long, they lean forward and then extend their back during the trunk erect phase.

22. Women who are under 5’ 4” usually cannot reach the floor with their feet when sitting. They need a footstool of some type.

23. If women have pain when sitting relaxed, make sure they are not holding their hips in adduction. Have them relax their hips completely (very hard to do because it is not “lady-like”) and often their pain is diminished.

WALKING AND STAIRS CONSIDERATIONS

24. When monitoring performance on stairs, determine at what phase the patient has pain. The hip flexion or the hip and knee extension. If it is during hip flexion, they need to tighten their abdominals to prevent any lumbar extension. If it occurs as they are putting their foot on the step, look for lateral pelvic tilt or rotation. If it occurs during the hip/knee extension phase, have them pull with their hand on the handrail and check for lumbar extension as the trunk becomes erect.

25. For patients with extension and/or rotation problems, they should take small steps when walking, tighten their abdominals and even monitor their pelvic motion with their hands to avoid any lumbar extension and/or rotation when walking.

PATIENTS WITH EXTENSION SYNDROME

26. For patients with extension problems, be careful not to push a higher level of lower abdominal exercises than can be done WITHOUT LOW BACK MOTION or PAIN. It is better to have them doing a lower level of lower abdominals than a level that will potentially contribute to their lumbar extension.

27. If the patient has a radiculopathy be even more careful about the lower abdominal progression because the iliopsoas attaches the discs as well as the transverse processes of the lumbar spine.

28. If a patient cannot lie supine with hips and knees extended, then one of their first goals should be to be able to accomplish this.

29. Low, low level of lower abdominals
   Start in the hooklying position:
   a. just lift one foot off the table, while tightening the abdominals.
   b. hold one knee to chest, tighten abs and slide other foot down extending the hip and knee. If the hip flexors are short, it is good to do this before and a few times post-low abdominal exercises.
   c. hold one knee to chest, tighten abs and lift over foot off table.
d. to progress, have the patient lessen the hold on the knee and allow the hip joint angle to approach 90 deg.

30. The patient with lumbar extension should be sure their back is flat and then be sure to keep it that way. If the patient with an extension syndrome has short iliopsoas, for abdominal exercises use:
   a. hold knee to chest with hand, TIGHTEN THE ABDOMINALS, and slide one leg down at a time.
   b. standing with back to the wall with hips and knees flexed, tighten the abdominals to flatten back against the wall, then straighten hips and knees.
   c. once the patient can flatten their back with hips and knees extended, they can try putting arms up over their head.

PATIENTS WITH FLEXION SYNDROME PROBLEMS

31. In the patient with lumbar flexion problems, do not have them emphasize flattening their back when doing lower abdominal exercises, but it should remain motionless.

PATIENTS WITH AXIAL LOADING COMPRESSION PROBLEMS

32. When the patient’s problems are related to axial loading the following activities help to decrease the loading:
   a. hands and knees rocking back
   b. sitting; push first into supporting surface, do push up by shoulder and elbow extension to take weight of trunk off spine. If there is a positive nerve tension sign during knee extension, doing this sitting push-up may allow greater range of knee extension before the onset of nerve signs.
   c. standing supporting upper trunk on counter with arms, and letting knees bend so that weight is not on feet.
   d. crutches can also be a help with this patient.

All of these methods should produce an immediate change in symptoms.

SIDELYING AND HIP ABDUCTION EXERCISES

33. Pain with sidelying is often because they are in a sidebend. Place your hand under their thorax at waist level to straighten the spine if the pain is reduced, they can use a towel with a few folds to support them in this position.

34. Sidelying hip abduction is useful for improving the performance of the lateral abdominals. Do not attempt to use the precision for hip abduction that is emphasized for improving gluteus medius performance. Most important part of exercise is being sure the patient is using their lateral abdominals to stabilize the pelvis. Palpate the lateral abdominals, if they do not become firm the patient is probably using their hip abductors on the opposite side and pushing into the table.