

# SPINAL SYNDROMES

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# spinal syndromes

- Also important to the orthopedic manual therapist are the subtle autonomic and visceral changes associated with spinal dysfunction and treatment in general, and the visceral disorders that mimic and are mimicked by spinal dysfunction.
- Although there are few clinical studies of these phenomena, such symptoms are commonly reported by patients and are important to monitor during OMT evaluation and treatment.

# Cervical syndromes

## Upper and mid-cervical spine disorders (occiput to C4)

sometimes present with symptoms of

- headache,
- migraine,
- dizziness,
- dysphasia,
- globus sensations,
- hoarseness,

- General irritability,
- autonomic reactions,
- disturbances in**
- hearing,
- sight
- cognition
- concentration
- memory

## The close proximity of the


- vertebral artery and nerves,
- medulla oblongata,
- cerebellum,
- pons,
- vagus and hypoglossal nerves,
- sympathetic ganglions of the neck

✓ may explain why mobilization of the upper cervical spine alleviates such symptoms.

# Lower cervical spine dysfunctions (C4 to T3)

**present primarily with**

- **local pain**
- **symptoms radiating into the upper thoracic area,**
- **shoulder girdle**
- **arm**

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- However, clinicians often report that mobilization in this region influences symptoms that seem to originate in the upper cervical spine.
  - It is possible that decreased mobility in one part of the spine (e.g., lower cervical or thoracic) disturbs function and provokes symptoms in another region (e.g., upper cervical).
  - ❖ Manual therapists sometimes augment mobilization treatment for upper cervical symptoms with mobilization to the lower cervical and upper thoracic regions, at least on a trial basis .

# Thoracic syndromes


- The anatomy of the thoracic spine is not substantially different from that of other spinal regions except that the spatial relationships in the spinal canal and the intervertebral foramen are larger than in other regions. This is probably why thoracic nerve root irritation is rare. On the other hand,
- the numerous small joints in this region, including the costovertebral and costotransverse joints, make the thoracic region more susceptible to painful joint restrictions, including the facet syndrome.


# Associated symptoms

also include

- pain in the corresponding intercostal area,
  - hyperesthesia in the area of the associated dermatome,
  - dominant pain in the anterior aspect of the thorax,
  - antalgic postures.
- Injuries to the thoracic spine can produce a painful segmental hypomobility in both children and adults.




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- However, patients over the age of fifty become more susceptible to thoracic segmental hypomobility as a result of the degenerative changes common in this age group (e.g., osteochondrosis or spondylosis).
  - Thoracic symptoms can be aggravated when older patients become bedridden, alarming both the patient and the health care provider because the associated severe pain and dyspnea can raise suspicions of heart or pulmonary involvement.


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- The OMT evaluation revealing a painful segmental restriction can be critical to the differential diagnosis in these cases.
  - A successful trial treatment of specific mobilization techniques can confirm the therapist's tentative diagnosis.

- The characteristic radiating pain associated with thoracic segmental dysfunctions, if dominant, can also mimic internal organ diseases, making differential diagnosis in the thoracic region difficult.
- Many internal organs share a common innervation with the thoracic spine, so symptoms can be similar with
  - heart,
  - gallbladder,
  - nephrolithiasis,
  - appendicitis,
  - thoracic spinal disorders
- The terms ***pseudoangina pectoris***, ***pseudodyskinesia***, and ***pseudoappendicitis*** are used to describe these diagnostic problems.

### *Hospital admission diagnoses with cases of thoracic segmental pain syndrome*

<i>Diagnosis</i>	<i>Number of cases</i>	<i>Effective Treatment</i>		<i>Positive thoracic x-ray</i>
		<i>Anesthesia</i>	<i>Mobilization</i>	
Angina Pectoris	8	2	5	1
Coronary Artery Thrombosis	5	1	3	
Heart Disease	10	2	4	4
Hyperventilation	5		5	
Pneumothorax	1			
Dyspnea	9	2	7	2
Gall Bladder	8	3	4	3
Kidney Disease	1	1		1
Chest Pain	28	1	24	5
<b>TOTALS</b>	<b>75</b>	<b>12</b>	<b>52</b>	<b>16</b>

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- The "facilitated segment" phenomenon further confuses attempts to distinguish between visceral and somatic problems, especially in the thoracic spine.
  - Any irritation within structures that share nervous innervation may decrease the pain threshold in the related vertebral segment.
  - For example, not only can irritation of a thoracic nerve root mimic symptoms of angina pectoris, but actual angina pectoris with symptoms in the thorax, shoulder, and arm can irritate the thoracic spine (via a facilitated segment) and cause or aggravate problems there.
  - Angina pectoris symptoms may even be temporarily relieved with thoracic mobilization.

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- ❑ Movement restrictions in the costovertebral and costotransverse joints are difficult to differentiate from other segmental syndromes.
  - ❑ If the symptoms are of articular origin, pressure applied to the rib or movement of the rib in a cranial or caudal direction increases symptoms.
  - ❑ Older people who have been bedridden for a period of time and athletes often exhibit these costal syndromes.
  - ❑ Tumors in the thoracic spine may irritate a thoracic nerve root and produce symptoms similar to segmental dysfunction .

# Causes of back Pain

## **Mechanical:**

- Apophyseal'osteoarthritis
- Diffuse idiopathic skeletal hyperostosis
- Degenerative discs
- Spinal disc herniation ("slipped disc")
- lumbar spinal stenosis
- Spondylolisthesis and other congenital abnormalities
- Fractures
- Sacroiliac joint dysfunction
- Leg length difference
- Restricted hip motion
- Misaligned pelvis - pelvic obliquity, anteversion or retroversion
- Abnormal foot pronation

## Inflammatory:

- ▣ Seronegative spondyloarthropathies (e.g. ankylosing spondylitis)
- ▣ Rheumatoid arthritis
- ▣ Infection - epidural abscess or osteomyelitis
- ▣ Sacroiliitis

## Neoplastic:

- ▣ Bone tumors (primary or metastatic)
- ▣ Intradural spinal tumors

## Metabolic:

- ▣ Osteoporotic fractures
- ▣ Osteomalacia
- ▣ Chondrocalcinosis



## □ Paget's disease


- Pelvic/abdominal disease
- Kidney
- Bladder
- appendix
- Prostate Cancer


## □ Cauda equina syndrome

- Posture
- Myofascial pain syndrome
- FM
- **Injury or overuse** of muscles, ligaments, and joints.
- **Pressure on nerve roots** in the spinal canal.

# Lumbar syndromes

- Lumbar spine syndromes simultaneously affecting
  - disc and facet joints
- In addition to the more common disc , synovial joint, and nerve root pathologies,
  - the lumbar spine is also susceptible to facet joint blocking by the meniscoids and to disc joint irritation by microrupture of the annulus

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- Acute low back pain, or lumbago, originating from a lumbar segment, is often misdiagnosed as a muscle sprain or spasm, because pain is localized in the paravertebral musculature.
  - However, any spasm or increased tension of the back extensor musculature would create or emphasize a lumbar lordosis, and most cases of acute low back pain are associated instead with a flattened or kyphotic lumbar curvature with an antalgic lateral shift.
  - Acute low back pain often recurs and can progress to a chronic lumbar dysfunction associated with degenerative discs and nerve root involvement.

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- With nerve root involvement, patients describe varying forms of lower extremity pain and paraesthesia.
  - These symptoms must be differentiated from pseudoradicular pain of visceral origin.
  - Visceral pain that mimics a nerve root problem and refers pain into the lower extremities is unlikely to benefit from mobilization treatment.

# Neurologic evaluation of nerve root syndromes

- The differential diagnosis of nerve root syndromes requires a working knowledge of the innervation patterns of the spinal nerve roots (including dermatomes, myotomes, and sclerotomes) and the peripheral nerves.
- Normal anatomical variations and overlapping patterns of segmental innervation require testing not only the key muscles and dermatomes in the suspected spinal region, but also the key muscles and dermatomes in the spinal segments above and below the suspected lesion.

# Sensory innervation of the skin

- When testing for sensory paraesthesias, the manual therapist
  - differentiates patterns of peripheral nerve innervation from segmental cutaneous innervation (dermatome).
- When a patient reports diffuse sensory disturbance there can be a significant amount of dermatomal overlap.
- Dermatomes

# Sensory innervation of deep structures

The segmental innervation of muscles (myotome), ligaments, and the periosteum (sclerotome) often differs from segmental cutaneous innervation (dermatome), especially in the extremities, the shoulder girdle, and the pelvis.

- For example, at the inferior angle of the scapula, the periosteum, the vascular supply, and the muscles are innervated by C8
- while the overlying skin is innervated by the T6 and T7 nerve roots
- Myotomes

# Motor innervation

- In the presence of motor loss, the manual therapist first determines whether the weakness is of peripheral or central origin .
- Monoradicular lesions are distal to the ventral horn and therefore can only be flaccid (not spastic).

These paresis can be differentiated with the use of manual muscle testing, evaluation of muscle atrophy, and electromyography ;

Almost all muscles in the body, even the smallest, are innervated by more than one nerve root. Those muscles innervated **mainly by one root are the key muscles most useful in the** evaluation of spinal nerve root lesions. Any loss of function or atrophy in a key muscle implicates a possible nerve root lesion at a particular spinal segment.

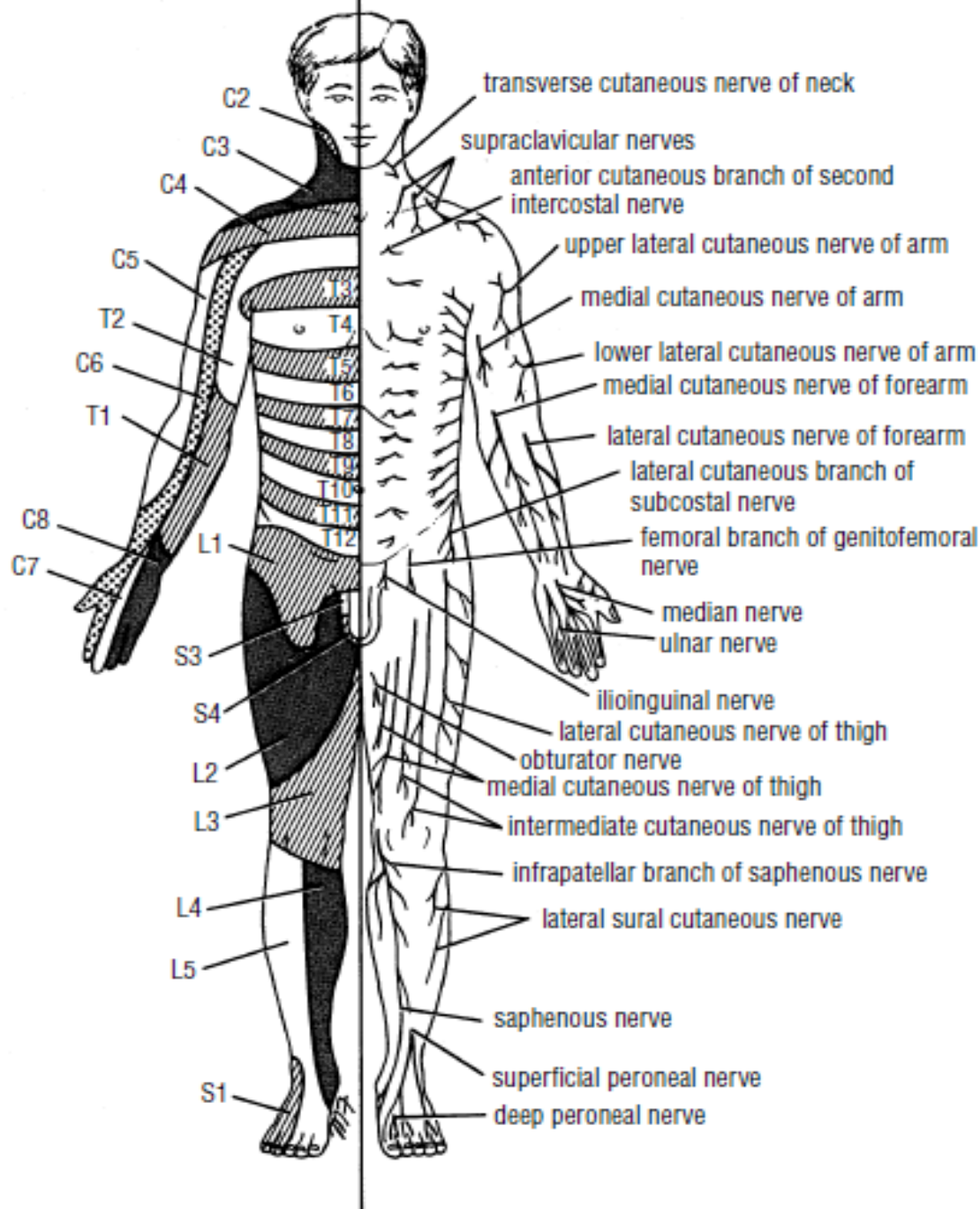


**Table 2: Cervicothoracic nerve root syndromes**

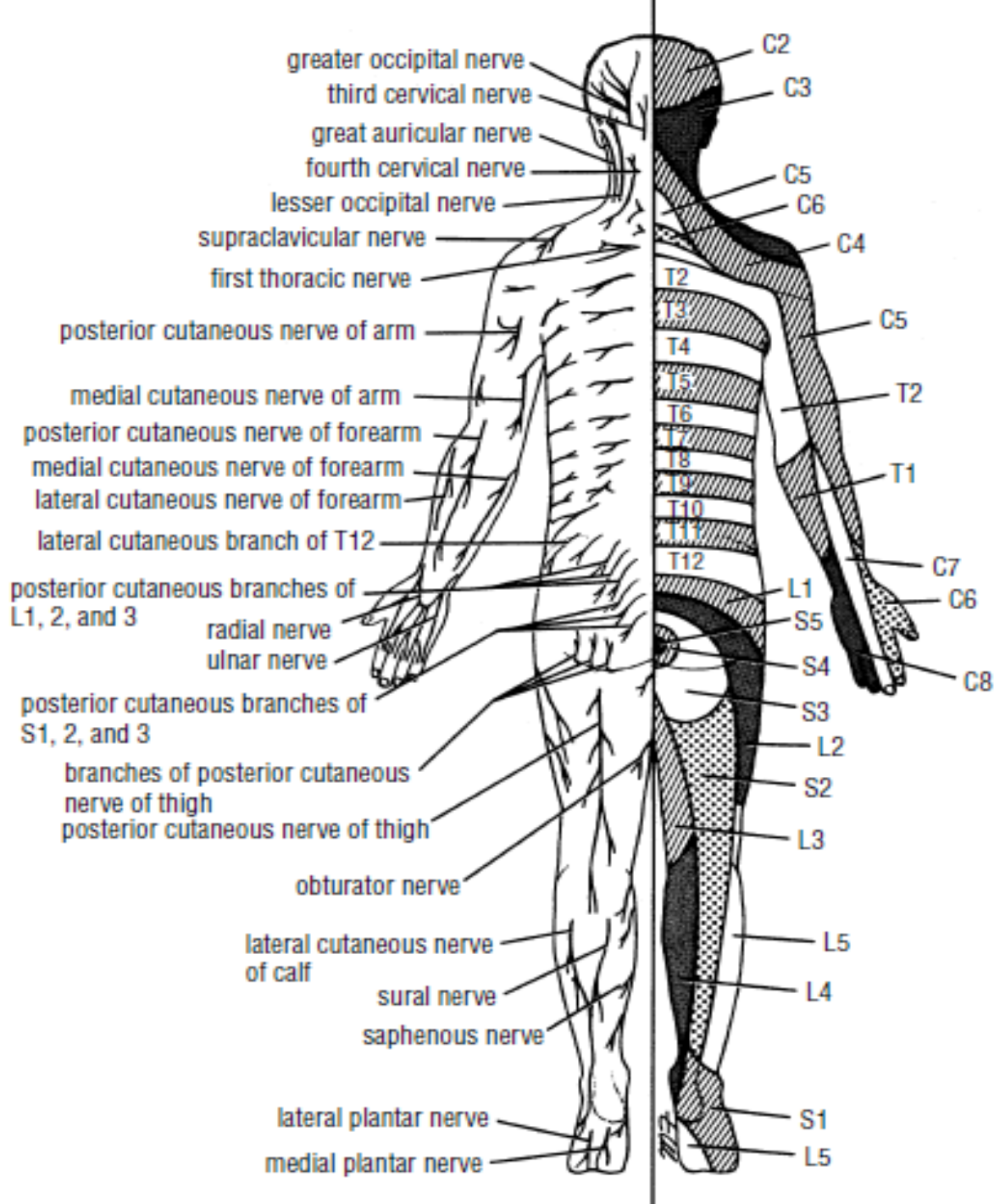
<b>Root</b>	<b>Key Muscle(s)</b>	<b>Reflex</b>	<b>Dermatome</b>
C1	Intrinsic upper cervical flexors and extensors between O-C1		
C2	Intrinsic upper cervical rotators between C1-C2		Posterior head
C3	Scaleni		"Shawl"
C4	Diaphragm		"Epaulets"
C5	Biceps brachii Infraspinatus and supraspinatus	Biceps tendon reflex	Shoulder and lateral side of upper arm
C6	Brachioradialis Wrist extensors	Brachioradialis reflex Radialperiosteal reflex	Forearm (radial side) Thumb and index finger
C7	Triceps brachii Wrist flexors Finger extensors Abductor pollicis brevis Opponens pollicis	Triceps tendon reflex	Forearm (dorsal side) Middle and index finger
C8	Flexor digitorum Adductor pollicis Abductor digiti minimi	Thumb reflex	Forearm (ulnar side) Small and ring fingers
T1	Interossei		Arm (medial side)

**Table 3: Lumbosacral nerve root syndromes**

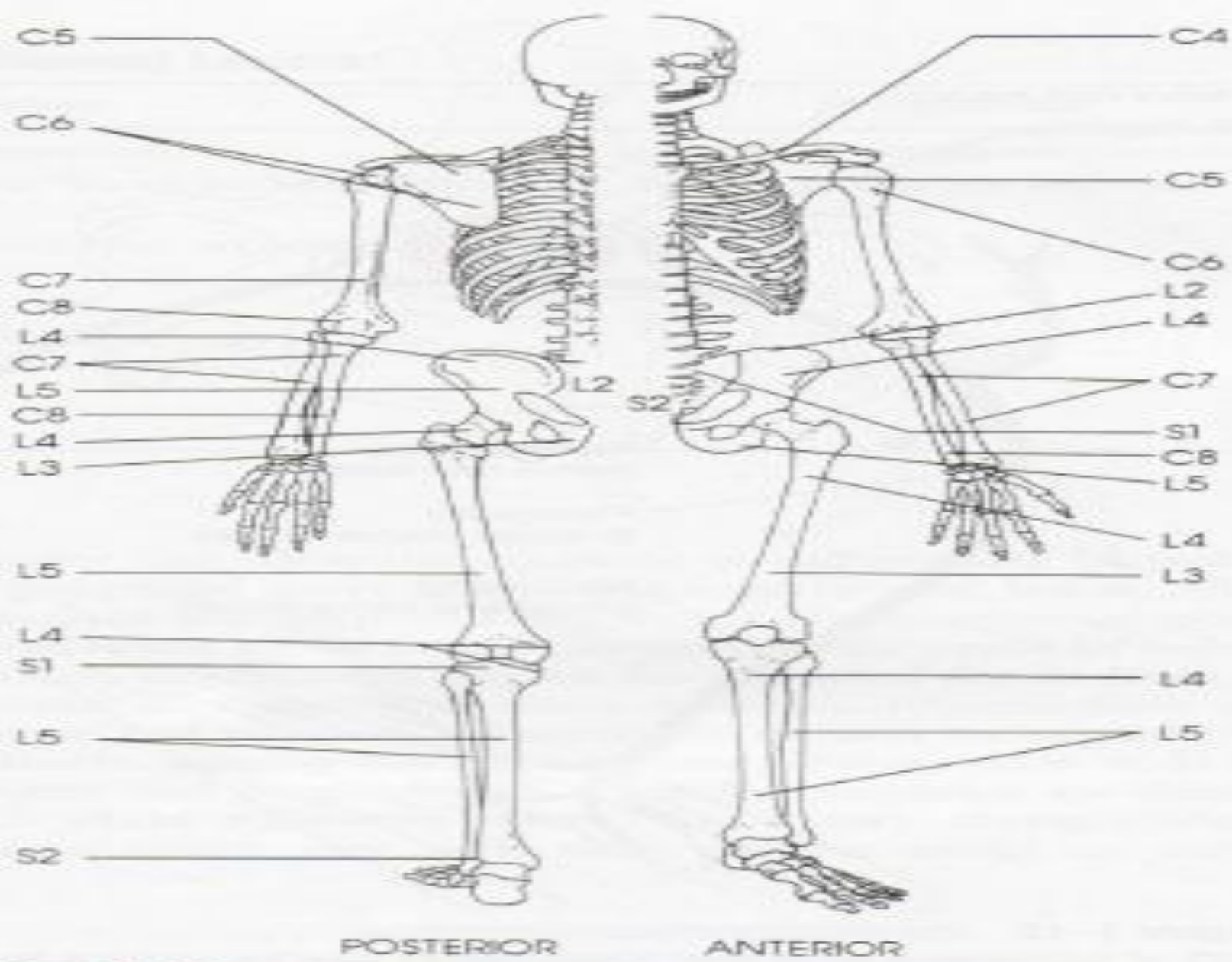
<b>Root</b>	<b>Key Muscle(s)</b>	<b>Reflex</b>	<b>Dermatome</b>
L1-2	Cremaster	Cremasteric reflex	Waist "backbelt"
L2-3	Hip adductors	Adductor reflex	Ventral thigh down to the knee
L4	Tibialis anterior Quadriceps (vastus medialis)	Patellar tendon reflex	Medial side of lower leg down to the malleolus
L5	Extensor hallucis longus Extensor digitorum longus and brevis Tibialis posterior	Tibialis posterior reflex Semitendinous reflex	Dorsal foot Big toe
S1	Peroneals Triceps surae (primarily gastrocnemius, medial)	Achilles tendon reflex	Lateral foot and sole Small toe



**CD Figure 1-2** Dermatomes and distribution of cutaneous nerves on the anterior aspect of the body.



**CD Figure 1-3** Dermatomes and distribution of cutaneous nerves on the posterior aspect of the body.



**Figure 1-11** Sclerotomes of the body. Lines show areas of bone and fascia supplied by individual nerve roots.

# **MCKENZIE'S THREE SYNDROMES**

**POSTURAL SYNDROME**

**DYSFUNCTION SYNDROME**

**DERANGEMENT SYNDROME**





# Postural Syndrome

According to McKenzie, patients with postural syndrome are usually

- less than 30 years old
- by definition, are devoid of restrictive barriers
- These patients develop symptoms that appear locally and usually adjacent to the spine.
- The pain is provoked by mechanical deformation of normal, healthy tissue when spinal segments are subjected to static loading over prolonged periods of time.
- The resulting pain disappears when the structure under load is released from tension.



The pain from postural syndrome is not induced by movement and is never referred to a distant site.

Because there is no associated inflammation, it is never constant.

- Examination of these patients fails to reveal impairment
  - because there is no underlying tissue pathology.
- The only consistent finding is pain provocation with static loading at end-range.
- Simply , postural pain develops gradually when normal tissues are overstretched.



# Intervention

The most useful intervention is

- to correct the faulty alignment wherever it is found (ie, Sitting, standing, lying, walking).

This may also involve an ergonomic assessment of

- furniture,
- computer height,
- mattresses,
- pillows, etc,
- as well as an analysis of the patient's conditions at the worksite.



The long-term complication of postural syndrome is that

- it can eventually cause pathologic changes in the soft tissues with resultant impairment.
- However, this will not likely occur with proper instruction in correct posture,
- ergonomic intervention,
- proper body mechanics.

# Dysfunction Syndrome

An uncorrected postural problem will cause

- pathologic changes over time

For example, a 35-year-old computer operator who spends 8 hours per day in a forward head position will eventually develop adaptive shortening of the occipital extensor muscles.

Likewise, the 40-year-old truck driver who spends 10 hours per day in a slumped sitting posture will eventually discover an inability to assume a normal lumbar lordosis in standing because of adaptive shortening of the trunk flexors.



These adaptive changes in connective tissue

- ie, loss of hyaluronic acid/water, adhesions
- represent pathophysiologic events that cause such macroscopic tissue impairment as
  - Restricted joint mobility,
  - muscle weakness,
  - faulty alignment

that is often associated with imbalance in the musculoskeletal system.



If the patient does not correct his or her impairment with the proper interventions,

- he or she can go on to develop functional limitations and disability,
- which can adversely affect performance at work, home.
- A distinguishing feature of the patient with dysfunction syndrome includes painful symptoms that tend to arise at the end of range rather than during movement.




This patient has intermittent pain similar to the postural patient, but differs in that his or her soft tissues are

➤ *abnormally tight*

□ The symptoms are usually adjacent to the spine and are never referred distally except in the case of an adherent nerve root.

Simply stated, the pain of dysfunction syndrome is produced immediately when shortened tissues are overstretched.



As with postural syndrome, dysfunction syndrome also has a long-term complication.

- If untreated with the appropriate intervention  
ie, manipulative therapy,
- It can cause more destructive pathology and result in the last of McKenzie's three syndromes, namely **derangement syndrome**.

However, in some cases a traumatic event In the absence of preexisting dysfunction is enough to cause derangement of the intervertebral disc.

## McKenzie's Three Syndromes

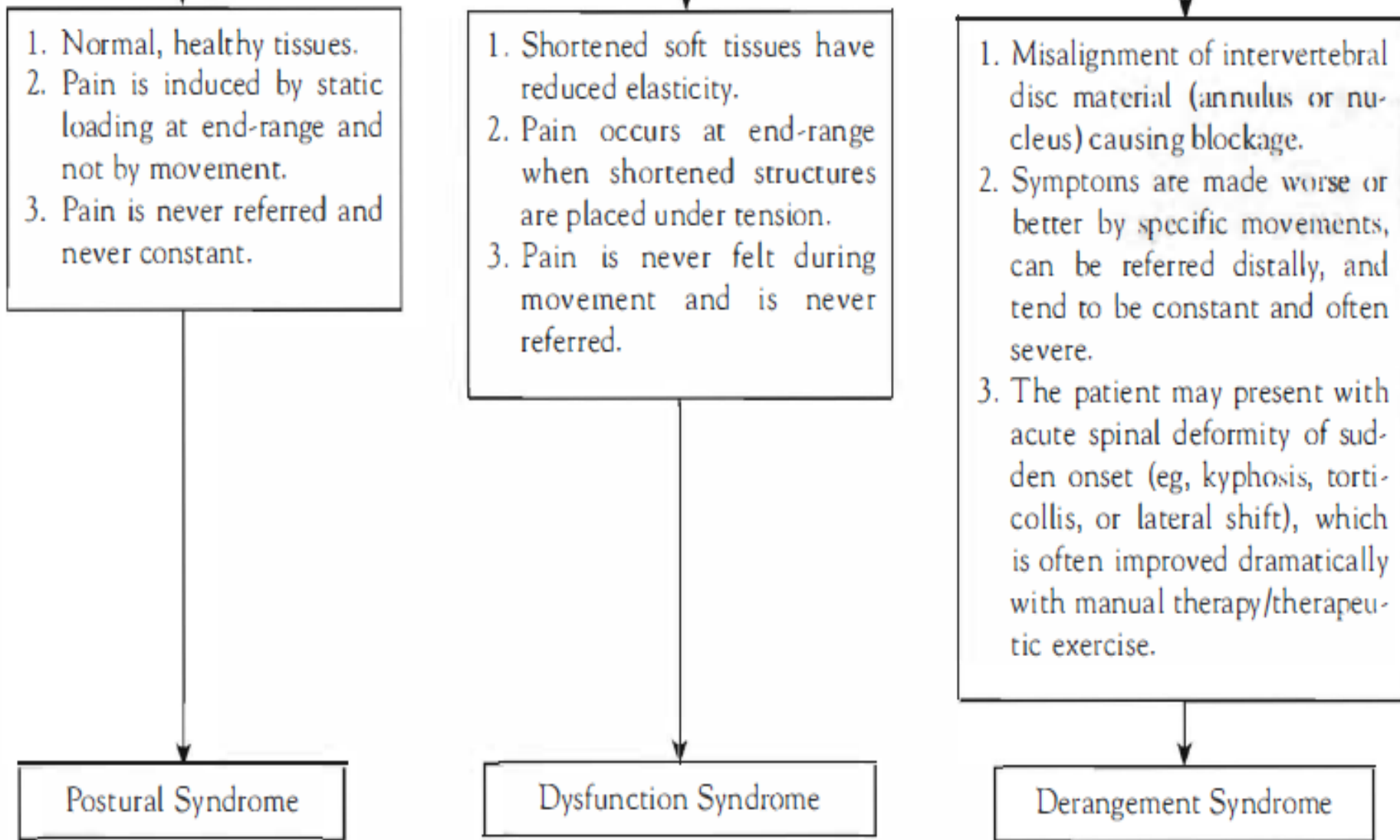


Figure 2-1. McKenzie's mechanical diagnosis of spinal pain and related symptoms.



# Derangement Syndrome

Characteristics of this syndrome can include

- neurologic signs and symptoms,
- pain during movement,
- acute deformity


eg, torticollis, lumbar kyphosis, lateral shift phenomenon,

- pain that is severe and disabling.

Patients with derangement syndrome often have a history of

- poor posture and progressive stiffness

- It is believed that the **lack of motion-based nutrition** in conjunction with **off-center loading** on the intervertebral disc causes the displacement of disc material.



The young are more likely to have a nuclear displacement, while those over the age of 50 tend to develop annular lesions.

- With the onset of degenerative disc disease,
- patients may develop clinical instability, which requires stabilization training of the hypermobile segment in conjunction with
  - manual therapy of the stiff, hypomobile segments above and/or below.

## Patients with derangement syndrome

(primarily occurring in the cervical and lumbar spine)  
often describe their neck and/or back as being  
"out."

- It is imperative that these patients be correctly diagnosed
- The deranged disc requires an approach that is quite different from dysfunction syndrome will not respond unless managed appropriately.

# The goals of intervention



The goals of intervention are as follows:

1. The derangement must be properly reduced.
2. The reduction must be stabilized in order for healing to occur.
3. Once the derangement is stable, lost function must be recovered.
4. The prevention of recurrence of the derangement must be emphasized.

# Patterns of dysfunction

- When a chain reaction evolves in which some
- muscles shorten and others weaken, predictable patterns involving imbalances develop,
  - Janda has described the ***upper and lower 'crossed' syndromes*** .

# Upper cross syndrome

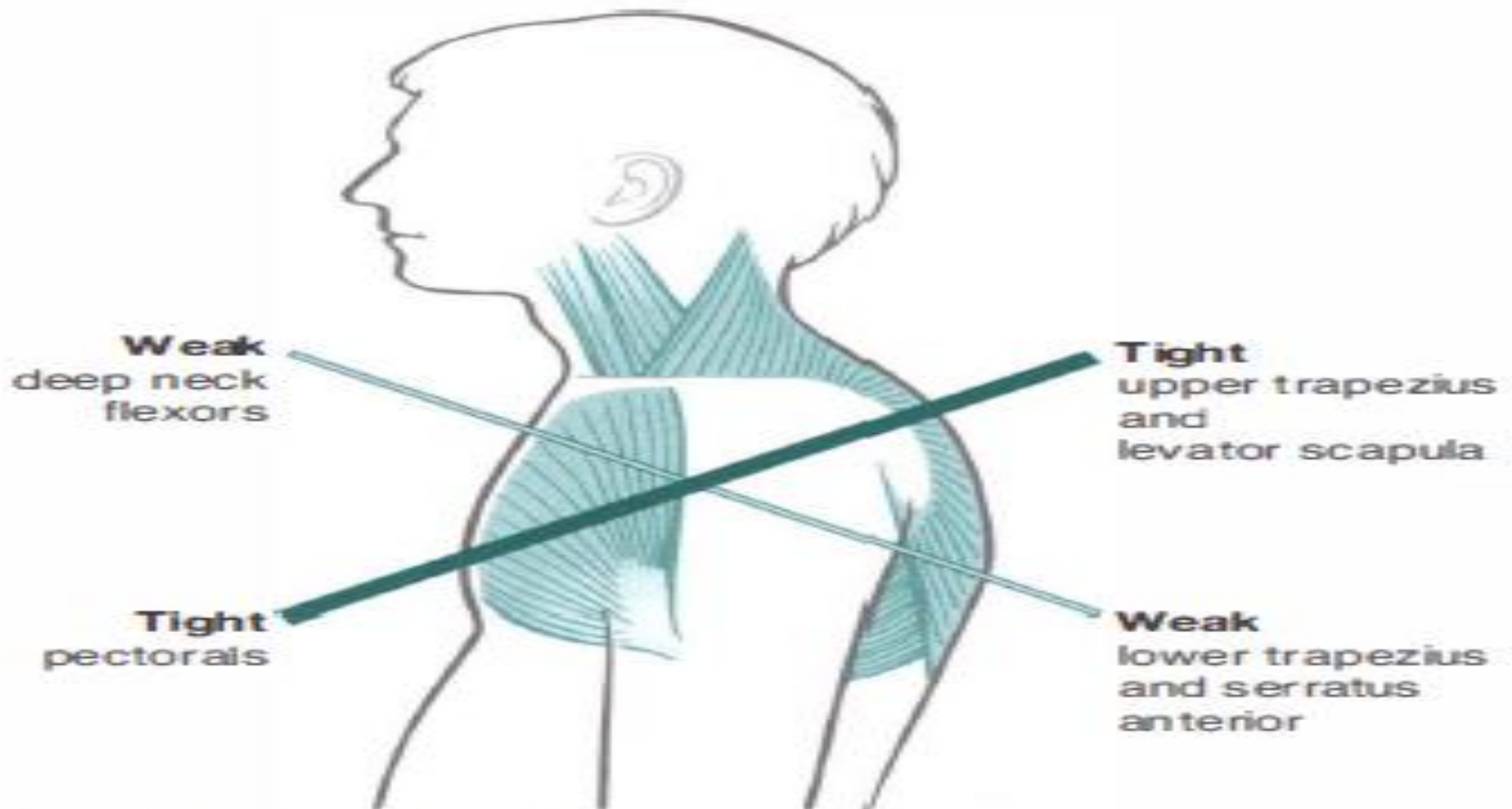


Figure 2.14 The upper crossed syndrome, as described by Janda.

Table 2.2 Upper crossed syndrome

Pectoralis major and minor	All tighten and shorten
Upper trapezius	
Levator scapulae	
Sternomastoid	
<i>while</i>	
Lower and middle trapezius	All weaken
Serratus anterior and rhomboids	

As the changes take place, they alter the relative positions of the head, neck and shoulders as follows:

1. The occiput and C1 /2 will hyperextend, with the head being pushed forward.
2. The lower cervical to 4th thoracic vertebrae will be posturally stressed as a result.
3. Rotation and abduction of the scapulae occurs.
4. An altered direction of the axis of the glenoid fossa will develop,
  - resulting in the humerus needing to be stabilised by additional levator scapula and upper trapezius activity
  - With additional activity from supraspinatus as well



The result of these changes is

- greater cervical segment strain
- referred pain to the chest, shoulders and arms.
- Pain mimicking angina may be noted plus a decline in respiratory efficiency.

The solution, according to Janda, is to be able

- to identify the shortened structures and to release (stretch and relax) them,
- followed by re-education towards more appropriate function.

# Lower crossed syndrome

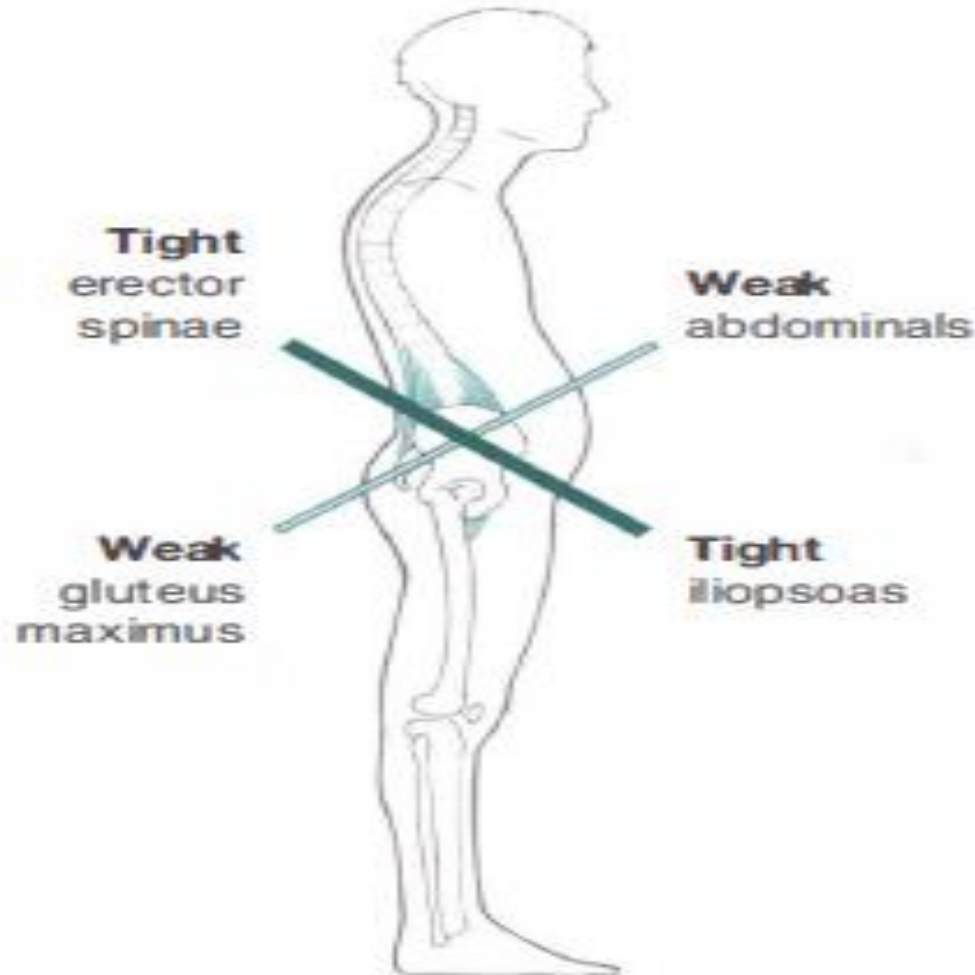


Figure 2.15 The lower crossed syndrome, as described by Janda.

## Table 2.3 Lower crossed syndrome

Hip flexors	All tighten and shorten
Illiopsoas, rectus femoris	
TFL, short adductors	
Erector spinae group of the trunk	
<i>while</i>	
Abdominal and gluteal muscles	All weaken



The result of the chain reaction is that

- the pelvis tips forward on the frontal plane,
- Flexion of the hip joints
- lumbar lordosis
- stress at LS-SI with pain and irritation.

A further stress commonly appears in the sagittal plane in which

- quadratus lumborum tightens
- gluteus maximus and medius weaken.



When this 'lateral corset' becomes unstable,

- The pelvis is held in increased elevation,
- when walking, resulting in LS-SI stress in the sagittal plane.
- One result is low-back pain
- The combined stresses described produce instability at the lumbodorsal junction,

Also commonly involved are the **Piriformis muscles**

- which in 20% of individuals are penetrated by the sciatic nerve so that piriformis syndrome can produce direct sciatic pressure and pain.
- Arterial involvement of piriformis shortness produces
  - ischaemia of the lower extremity,
  - through a relative fixation of the sacrum,
  - Sacroiliac dysfunction
  - pain in the hip



Part' of the solution for an all too common pattern such as

- to identify the shortened structures and to release them,  
followed by
- re-education of posture and use