

Low Back Pain

Clinically differentiating high lumbar radiculopathy and rectus femoris muscle strain

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Disclosure

The speakers indicated they have no conflicts with commercial interest companies to disclose relevant to the content of this educational activity.

Objectives

General

- Understand the clinical presentation of high lumbar radiculopathy, femoral neuropathy, and rectus femoris strain
- Understand diagnostic dilemma in differentiating high lumbar radiculopathy, femoral neuropathy, and rectus femoris strain in the context of low back pain

Physical therapy (PT)

- Summarize PT approach to differentiating femoral neuropathy and rectus femoris strain in patient presenting with low back pain
- Summarize PT treatment approach for femoral neuropathy versus rectus femoris strain

Osteopathic manual medicine (OMM)

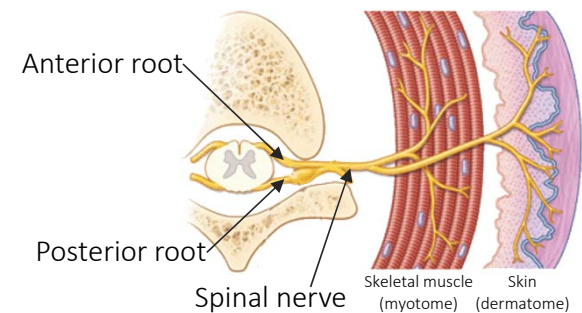
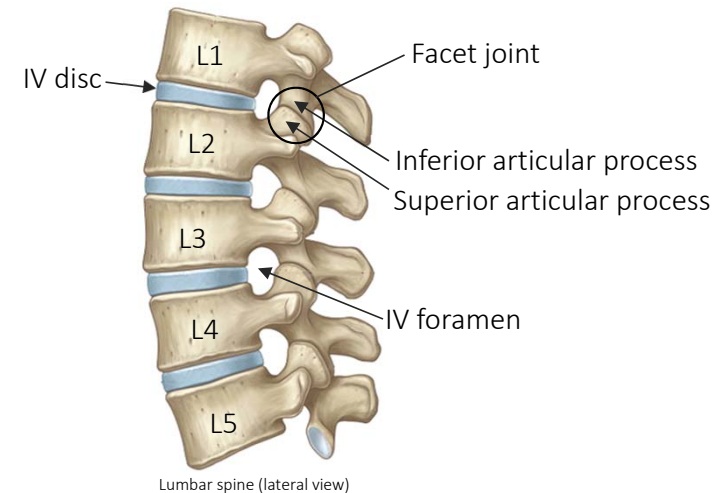
- Learn a physical exam maneuver to differentiate high lumbar radiculopathy from rectus femoris muscle strain
- Understand the relevant anatomy of the physical exam maneuver
- Understand the utility of the physical exam maneuver in clinical decision-making

Outline

- Anatomy review – lumbar spine, spinal nerves
- High lumbar radiculopathy definition and clinical presentation
- Femoral neuropathy definition and clinical presentation
- Rectus femoris muscle anatomy and response to injury
- Rectus femoris muscle strain clinical presentation
- Case: 52 year-old female with low back pain and anterior thigh tightness
- Physical therapy diagnostic and treatment approach
- Proposed diagnostic approach – modified femoral nerve stretch test

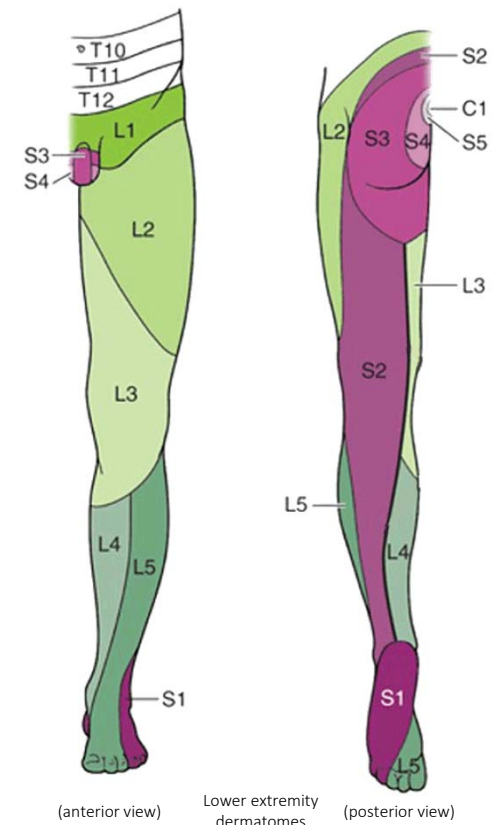
Multiple structures may be sources of low back pain

- 5 lumbar vertebrae
 - Separated by intervertebral (IV) discs
- IV foramen provide passageway for spinal nerves
 - Single spinal nerves innervate an area of skin (dermatome)
 - Single spinal nerves innervate muscle fibers (myotome)
- 5 pairs of lumbar spinal nerves (L1-5)
 - Exit below corresponding vertebra, above corresponding IV disc
- Portions of spinal nerves may combine to form peripheral nerves



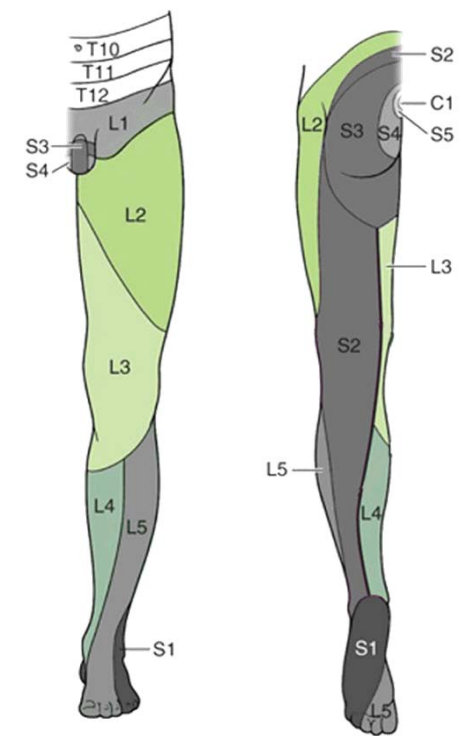
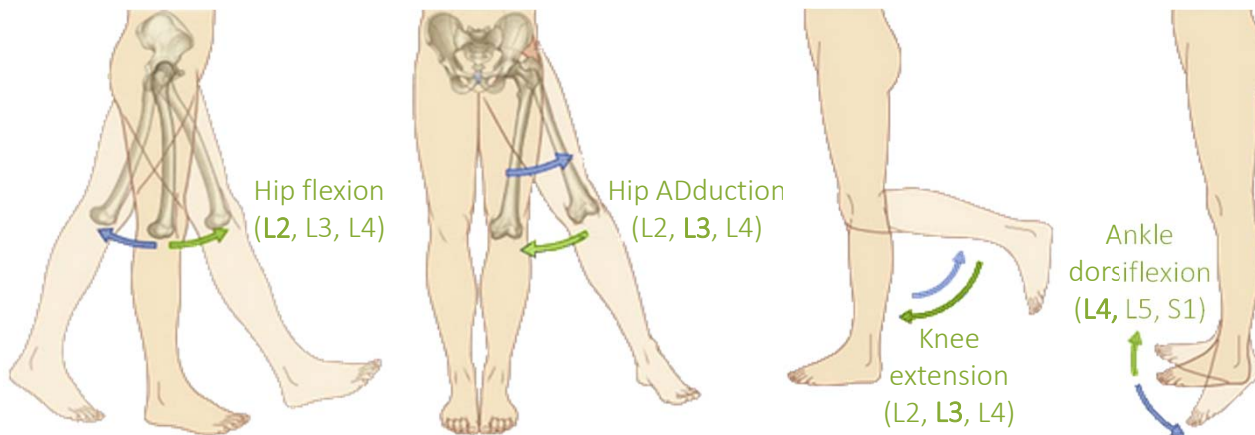
Radiculopathy: nerve root problem

- Radiculopathy: nerve root problem (e.g. compression/injury)
- Potential causes: IV disc herniation, bone spur
- Clinical presentation:
 - Sensory, motor, reflex abnormalities in distribution of affected nerve root(s)
 - Pain in dermatomal distribution of affected nerve root(s)
 - +/- hyperalgesia (exaggerated pain in response to noxious stimulus)
 - +/- allodynia (pain in response to non-noxious stimulus)



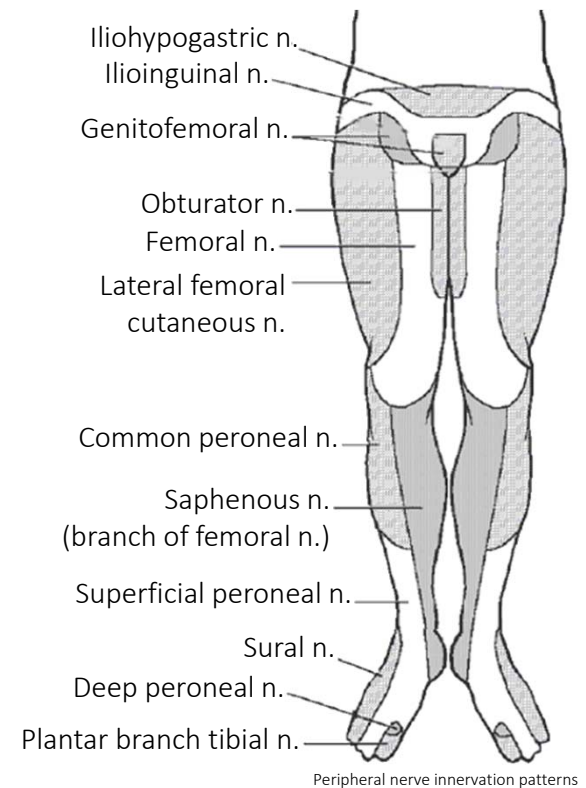
High lumbar radiculopathy: L2, L3, and/or L4 root compromise

- High lumbar radiculopathy: compression/injury of L2, L3, and/or L4 nerve roots
- Clinical presentation:
 - Pain in low back and anterior thigh
 - Sensory abnormalities in anterior thigh, groin, medial leg
 - Weak hip flexion, hip ADduction, ankle dorsiflexion
 - Reduced/absent patellar reflex (L4)



Neuropathy: peripheral nerve problem

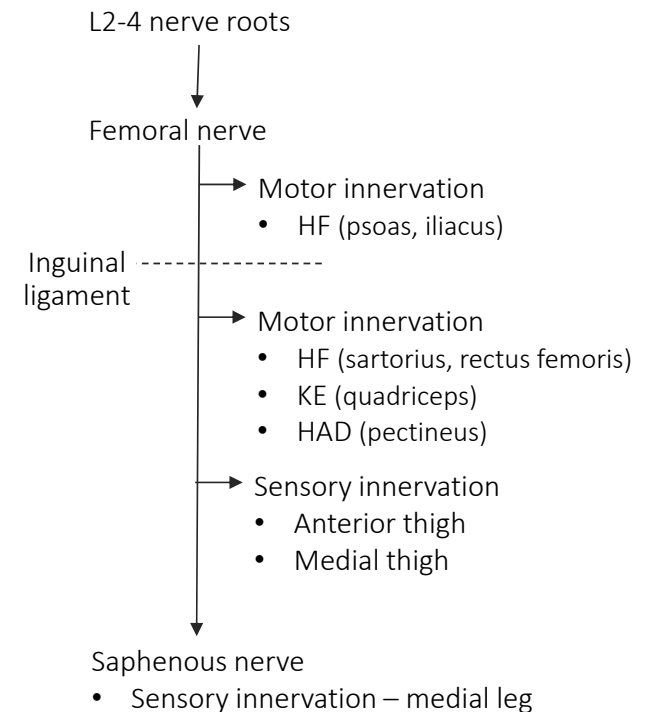
- Neuropathy: peripheral nerve problem (e.g. compression/injury)
- Potential causes: trauma, surgery, entrapment
- Clinical presentation:
 - Sensory, motor, reflex abnormalities in distribution of affected nerve
 - Pain in dermatomal distribution of affected nerve
 - +/- hyperalgesia
 - +/- allodynia



Peripheral nerve innervation patterns

Femoral neuropathy: femoral nerve compromise

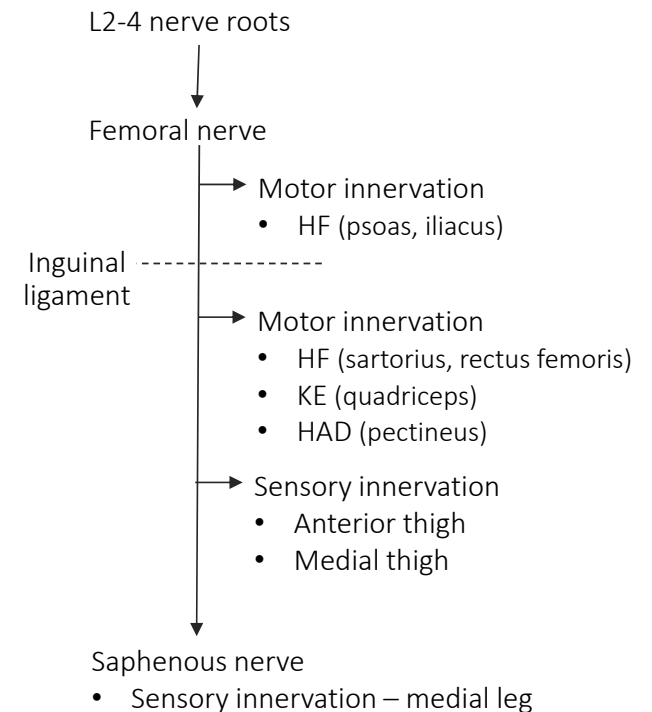
- Femoral neuropathy: compression/injury of femoral nerve
- Femoral nerve comprised of L2-4 nerve roots
 - Courses between psoas and iliacus in retroperitoneal space → under inguinal ligament → anterior thigh
- Innervation:
 - Motor
 - Hip flexors (psoas, iliacus, sartorius, rectus femoris)
 - Knee extensors (quadriceps)
 - Hip ADductor (pectineus)
 - Sensory
 - Anterior and medial thigh
 - Medial leg (via saphenous nerve)



HF: hip flexion
KE: knee extension
HAD: hip ADduction

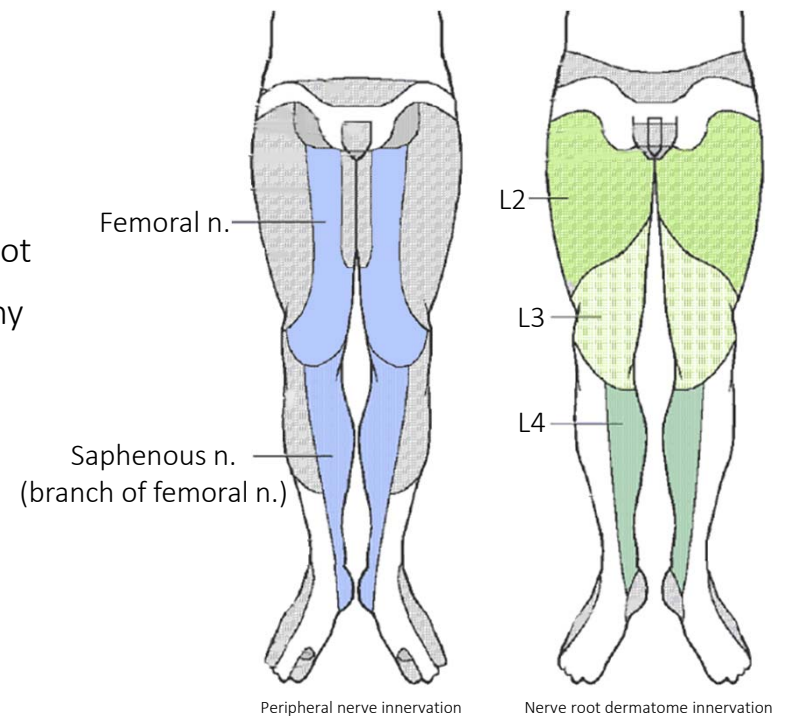
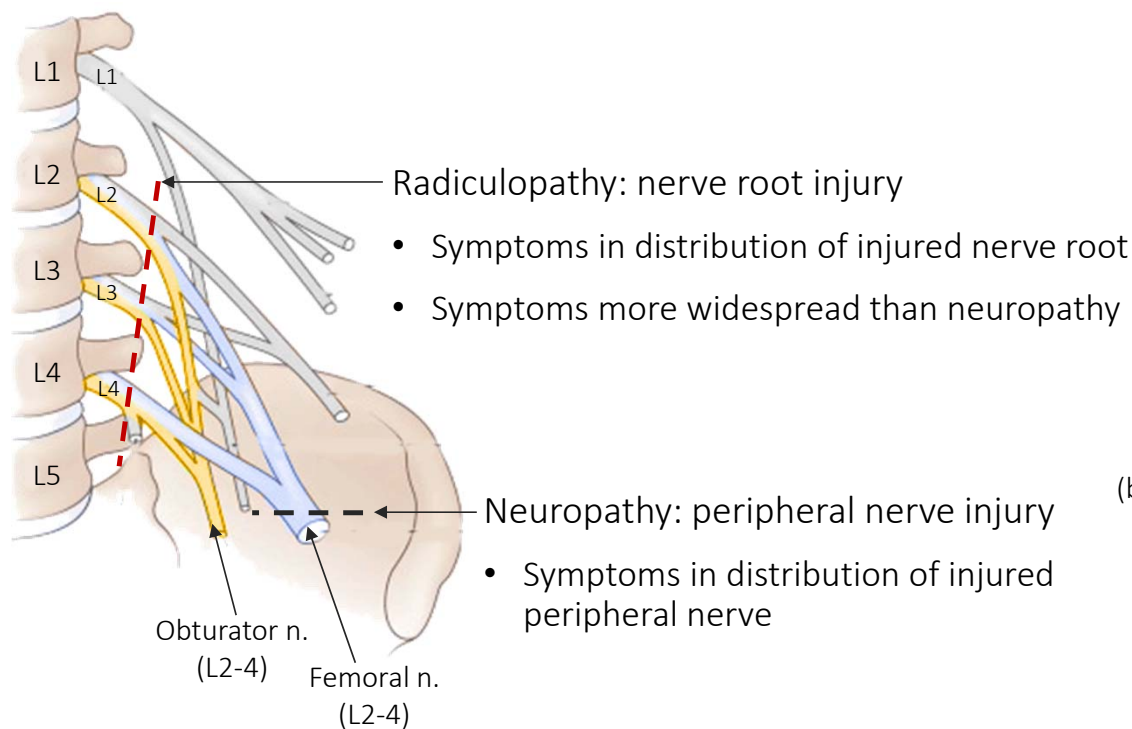
Femoral neuropathy presentation varies with injury location

- Commonly compromised in retroperitoneal space or under inguinal ligament
- Neurologic symptoms distal to site of injury
 - Injury at/distal to inguinal ligament
 - Weak knee extension
 - Pain/abnormal sensation in **anterior thigh**, medial thigh, medial leg
 - Reduced/absent patellar reflex
 - Injury proximal to inguinal ligament
 - Weak knee extension, hip flexion
 - Pain/abnormal sensation in **anterior thigh**, medial thigh, medial leg
 - Reduced/absent patellar reflex
- May present with **low back pain**



HF: hip flexion
KE: knee extension
HAD: hip ADduction

L2-4 radiculopathies & femoral neuropathy may present similarly

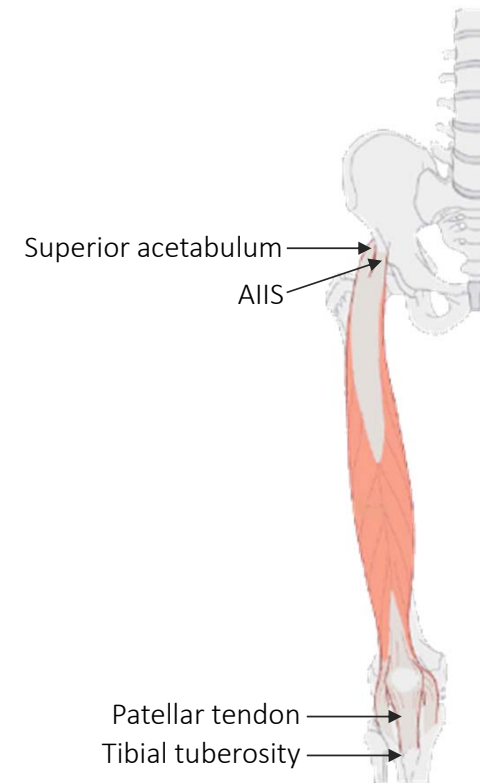


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Rectus femoris injury can cause/contribute to low back pain

- Rectus femoris muscle
 - Origins: anterior inferior iliac spine (AIIS), superior acetabulum
 - Insertion: patellar tendon, tibial tuberosity
- Response to injury: shorten, tighten, strained
 - Short: contracted
 - Tight: muscle fibers short
 - Strain: muscle/tendon tear
- Clinical presentation
 - Low back pain
 - Anterior thigh pain



High lumbar radiculopathy, femoral neuropathy, and rectus femoris strain **present similarly (pain in low back/anterior thigh)**

Clinically differentiating the etiologies can be challenging but is important in determining further workup and treatment

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52 year-old female with low back pain and thigh tightness

- Follow-up visit to DMU OMM Clinic
- Extensive past medical history, including chronic pain in multiple areas
- Relevant subjective and objective findings emphasized here

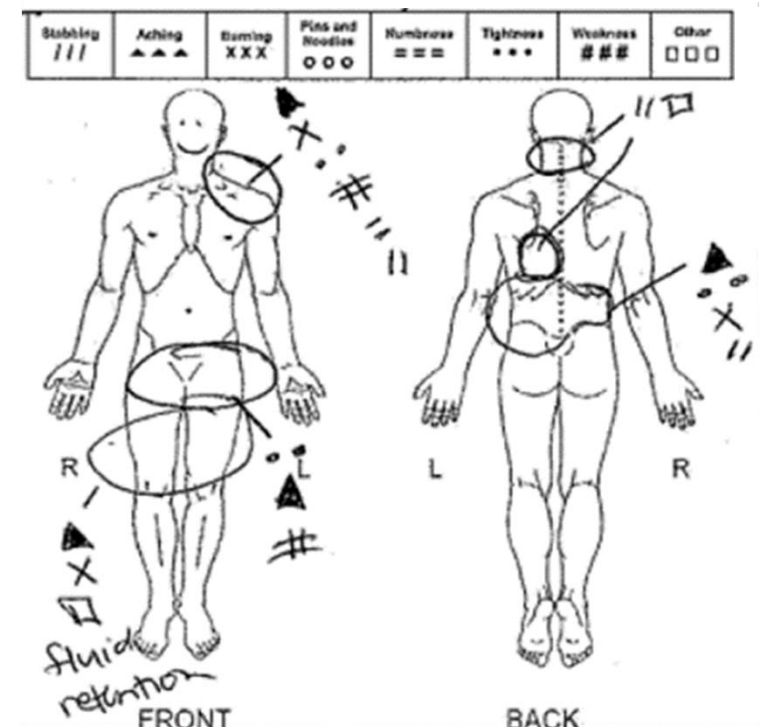
52 year-old female with low back pain and thigh tightness

Subjective

CC: low back pain (LBP), tight thighs, shoulder pain, tight neck

HPI:

- LBP, bilaterally, left > right
 - Began 6 months ago
 - Described as achy, tight, burning, stabbing
- Anterior thigh tightness, bilaterally
 - Began in the last month
 - Described as achy/burning on the right, achy/tight/weak on the left
- Both LBP and thigh tightness
 - Pain level 3.5/10, constant
 - Better with heat, rest, stretching, short time on incline table
 - Worse with sitting/walking too long, bending, twisting, lifting
- Fell 2 months prior to visit, reports due to “balance” issues
 - Fell backwards, caught self on chair/table, denies major injuries



Symptom diagram, completed by patient on follow-up questionnaire 17

52 year-old female with low back pain and thigh tightness

Subjective (continued)

ROS:

- Reports muscle aches, weakness, numbness, joint pain, back pain, leg swelling, difficulty moving limbs
- Denies tingling, bowel/bladder incontinence or retention, saddle anesthesia, pain that wakes her up at night, unplanned weight loss

Past medical history:

- Fibromyalgia with chronic pain in multiple areas
- Chronic low back pain with recurrent muscle spasms in middle and low back, onset 6 months ago
- Scoliosis
- Osteoporosis

Medications: multiple, notably hydrocodone/acetaminophen, 1 tab every 4-6 hours as needed for pain

Past surgical history, family history, social history, allergies not relevant to this presentation

52 year-old female with low back pain and thigh tightness

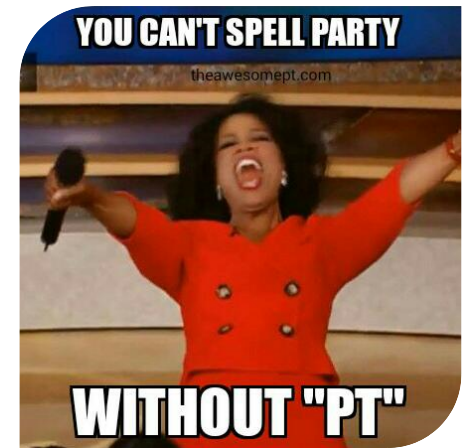
Objective

Physical exam:

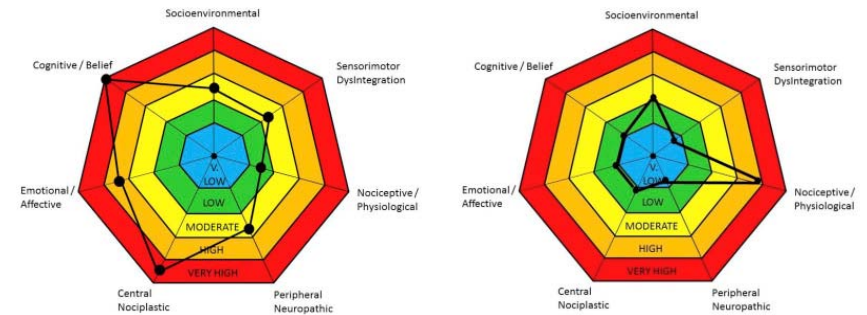
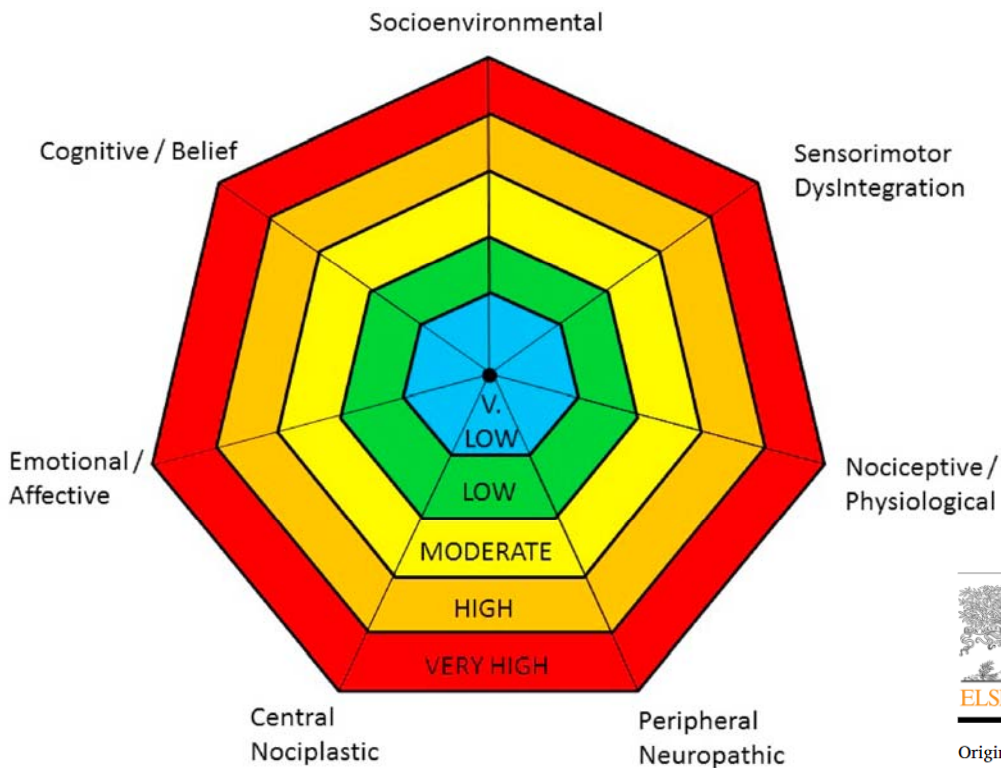
- Vitals: BP 128/76, HR 88, Wt 179 lbs, Ht 5'7"
- General: well-appearing, no acute distress
- Cardiovascular: no lower extremity edema on inspection or palpation
- Skin: warm, dry, no rash on exposed areas of low back and lower extremities
- Musculoskeletal exam to be explained from physical therapy and osteopathic medicine approach

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Original article

A new clinical model for facilitating the development of pattern recognition skills in clinical pain assessment[☆]

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^b Faculty of Health Sciences, The University of Sydney, and the Kolling Institute, Royal North Shore Hospital, NSW, Australia



Pain Phenotyping

Table 1

Examples of tools or clinical signs currently available for estimating magnitude of dysfunction/impact in each of the 7 domains described by the sample radar plot. NSAIDs = Non-Steroidal Anti-Inflammatories, TCA = Tricyclic Antidepressants, SSRI = Selective Serotonin Reuptake Inhibitors, SNRI = Serotonin & Norepinephrine Reuptake Inhibitors.

Assessment Domain	Nociceptive (Physiological) input	Peripheral Neuropathy	Central Nociceptive Mechanisms	Emotional Dysregulation	Maladaptive Cognitions or Beliefs	Socioenvironmental Context	Sensorimotor Dys-integration
History of the complaint	<ul style="list-style-type: none"> Complaints are proportionate to the mechanism 	<ul style="list-style-type: none"> Mechanism of onset consistent with trauma of a peripheral nerve 	<ul style="list-style-type: none"> More difficult to draw connection between mechanism of onset and current complaints 	<ul style="list-style-type: none"> History of psychopathology especially if temporally related to other symptom onset 	<ul style="list-style-type: none"> No defined pattern, can be acute or chronic, traumatic or non-traumatic 	<ul style="list-style-type: none"> May be more likely when pathogenesis has occurred in a compensable environment or linked to other stressors 	<ul style="list-style-type: none"> More likely to manifest in chronic problems
Patient narrative	<ul style="list-style-type: none"> Well-localized pain complaints 	<ul style="list-style-type: none"> Spontaneous or 'ectopic' pain, allodynia and local hyperalgesia 	<ul style="list-style-type: none"> Resting pain (local or widespread), may be related to mood or emotional status 	<ul style="list-style-type: none"> Symptoms consistent with psychopathology (e.g. DSM-V criteria) 	<ul style="list-style-type: none"> Examples: Belief that hurt = harm, or that 100% relief is required before resuming activity 	<ul style="list-style-type: none"> Feels under constant scrutiny or surveillance (e.g. medicolegal involvement) 	<ul style="list-style-type: none"> Describes the injured body region as though it is detached from self
Standardized self-report evaluations	<ul style="list-style-type: none"> Responses do not support other drivers in the framework 	<ul style="list-style-type: none"> Self-report diagnostic tools (e.g. SLANSS^a) 	<ul style="list-style-type: none"> Self-report diagnostic tools (e.g. CSI^d) 	<ul style="list-style-type: none"> Self-report diagnostic tools (e.g. PHQ-9^f, PCL^g) 	<ul style="list-style-type: none"> Self-report evaluative tools (e.g. PCS^j, TSK^j, FABQ^h) 	<ul style="list-style-type: none"> Self-report evaluative tools (e.g. SRIⁱ, IEQ^m) 	<ul style="list-style-type: none"> Few available, but may struggle to identify painful areas on a body diagram
Standardized clinical evaluations and signs	<ul style="list-style-type: none"> Consistent and predictable movement-related pain behaviour 	<ul style="list-style-type: none"> Clinical signs of pain or impaired neural transmission along the course of a known sensory nerve 	<ul style="list-style-type: none"> Non-mechanical and non-predictable patterns of pain reproduction, with/without dysfunctional descending pain modulation^e 	<ul style="list-style-type: none"> Pain not consistent with predictable mechanical patterns 	<ul style="list-style-type: none"> Exaggerated or inconsistent pain behaviours out of proportion to magnitude of testing 	<ul style="list-style-type: none"> Signs suggestive of intentional exaggeration may provide a clue, but careful interpretation is encouraged 	<ul style="list-style-type: none"> Signs of somatosensory reorganization (e.g. 2PDⁿ, JPSE^o)
Other observations	<ul style="list-style-type: none"> Responsive to routine front-line pharmacotherapy 	<ul style="list-style-type: none"> Not responsive to NSAIDs, may be responsive to TCAs^b, SNRIs^c, pregabalin or gabapentin 	<ul style="list-style-type: none"> Not responsive to routine front-line therapies, may be responsive to opioids, TCAs and/or SSRIs 	<ul style="list-style-type: none"> Small to no effect on pain from front-line pharmacotherapy, may see effect from TCAs^b or SSRIs^h/SNRIs^c 	<ul style="list-style-type: none"> Preference for avoidant or passive coping methods, 'all or none'-type thinking 	<ul style="list-style-type: none"> Counseled to avoid activity or 'straining' until after case is settled 	<ul style="list-style-type: none"> May require exploration and exclusion of a CNS disorder

Pain P

Table 1

Examples of tools or clinical signs currently available for estimating maladaptive cognitions or beliefs, sensorimotor dys-integration, and pain. TCA = Tricyclic Antidepressants, SSRI = Selective Serotonin Reuptake Inhibitors.

Assessment Domain	Nociceptive (Physiological) input	Peripheral Neuropathy
History of the complaint	<ul style="list-style-type: none"> Complaints are proportionate to the mechanism 	<ul style="list-style-type: none"> Mechanism of onset consistent with trauma of a peripheral nerve
Patient narrative	<ul style="list-style-type: none"> Well-localized pain complaints 	<ul style="list-style-type: none"> Spontaneous or 'ectopic' pain, allodynia and local hyperalgesia
Standardized self-report evaluations	<ul style="list-style-type: none"> Responses do not support other drivers in the framework 	<ul style="list-style-type: none"> Self-report diagnostic tools (e.g. SLANSS^a)
Standardized clinical evaluations and signs	<ul style="list-style-type: none"> Consistent and predictable movement-related pain behaviour 	<ul style="list-style-type: none"> Clinical signs of pain or impaired neural transmission along the course of a known sensory nerve
Other observations	<ul style="list-style-type: none"> Responsive to routine front-line pharmacotherapy 	<ul style="list-style-type: none"> Not responsive to NSAIDs, may be responsive to TCAs^b, SNRIs^c, pregabalin or gabapentin

Examples of tools or clinical signs currently available for estimating maladaptive cognitions or beliefs, sensorimotor dys-integration, and pain. NSAIDs = Non-Steroidal Anti-Inflammatories, TCA = Tricyclic Antidepressants, SSRI = Selective Serotonin Reuptake Inhibitors.

Assessment Domain	Maladaptive Cognitions or Beliefs	Socioenvironmental Context	Sensorimotor Dys-integration
History of the complaint	<ul style="list-style-type: none"> No defined pattern, can be acute or chronic, traumatic or non-traumatic 	<ul style="list-style-type: none"> May be more likely when pathogenesis has occurred in a compensable environment or linked to other stressors 	<ul style="list-style-type: none"> More likely to manifest in chronic problems
Patient narrative	<ul style="list-style-type: none"> Examples: Belief that hurt = harm, or that 100% relief is required before resuming activity 	<ul style="list-style-type: none"> Feels under constant scrutiny or surveillance (e.g. medicolegal involvement) 	<ul style="list-style-type: none"> Describes the injured body region as though it is detached from self
Standardized self-report evaluations	<ul style="list-style-type: none"> Self-report evaluative tools (e.g. PCS^d, TSK^d, FABQ^h) 	<ul style="list-style-type: none"> Self-report evaluative tools (e.g. SRIⁱ, IEQ^m) 	<ul style="list-style-type: none"> Few available, but may struggle to identify painful areas on a body diagram
Standardized clinical evaluations and signs	<ul style="list-style-type: none"> Exaggerated or inconsistent pain behaviours out of proportion to magnitude of testing 	<ul style="list-style-type: none"> Signs suggestive of intentional exaggeration may provide a clue, but careful interpretation is encouraged 	<ul style="list-style-type: none"> Signs of somatosensory reorganization (e.g. 2PDⁿ, JPSE^o)
Other observations	<ul style="list-style-type: none"> Preference for avoidant or passive coping methods, 'all or none'-type thinking 	<ul style="list-style-type: none"> Counseled to avoid activity or 'straining' until after case is settled 	<ul style="list-style-type: none"> May require exploration and exclusion of a CNS disorder

Self-report version of the Leeds Assessment of Neuropathic Signs and Symptoms (SLANSS)

- Score > 12 suggestive of a predominantly neuropathic origin

1. In the area where you have pain, do you also have "pins and needles", tingling or prickling sensations?	
<input type="checkbox"/> NO – I don't get these sensations	0
<input type="checkbox"/> YES – I get these sensations	5
2. Does the painful area change colour (perhaps look mottled or more red) when the pain is particularly bad?	
<input type="checkbox"/> NO – The pain does not affect the colour of my skin	0
<input type="checkbox"/> YES – I have noticed that the pain does make my skin look different from normal.	5
3. Does your pain make the affected skin abnormally sensitive to touch? Getting unpleasant sensations or pain when lightly stroking the skin might describe this.	
<input type="checkbox"/> NO – The pain does not make my skin abnormally sensitive to touch.	0
<input type="checkbox"/> YES – My skin in that area is particularly sensitive to touch.	3
4. Does your pain come on suddenly and in bursts for no apparent reason when you are completely still? Words like "electric shocks", jumping and bursting might describe this.	
<input type="checkbox"/> NO – My pain doesn't really feel like this.	0
<input type="checkbox"/> YES – I get these sensations often.	2
5. In the area where you have pain, does your skin feel unusually hot like a burning pain?	
<input type="checkbox"/> NO – I don't have burning pain	0
<input type="checkbox"/> YES – I get burning pain often	1
6. Gently rub the painful area with your index finger and then rub a non-painful area (for example, an area of skin further away or on the opposite side from the painful area). How does this rubbing feel in the painful area?	
<input type="checkbox"/> The painful area feels no different from the non-painful area	0
<input type="checkbox"/> I feel discomfort, like pins and needles, tingling or burning in the painful area that is different from the non-painful area.	5
7. Gently press on the painful area with your finger tip and then gently press in the same way onto a non-painful area (the same non-painful area that you chose in the last question). How does this feel in the painful area?	
<input type="checkbox"/> The painful area does not feel different from the non-painful area.	0
<input type="checkbox"/> I feel numbness or tenderness in the painful area that is different from the non-painful area.	3
Total score:	

Let's get SMART about pain...Keith Smart



Nociceptive Pain

Subjective

- Intermittent, sharp pain with aggravation
- Dull ache or throbbing at rest
- Mechanical nature to aggravating/easing factors
- Pain proportional to injury/pathology
- Pain localized to area of injury/pathology
- Resolves in accordance with expected tissue healing times
- Responsive to simple analgesics
- Pain in association with symptoms of inflammation
- Pain of recent onset

Objective

- Clear, consistent and proportionate mechanical/anatomical pattern of pain reproduction on movement or mechanical testing of target tissues
- Localized pain on palpation
- Absence of hyperalgesia or allodynia
- Pain relieving postures or movement patterns

Neuropathic Pain

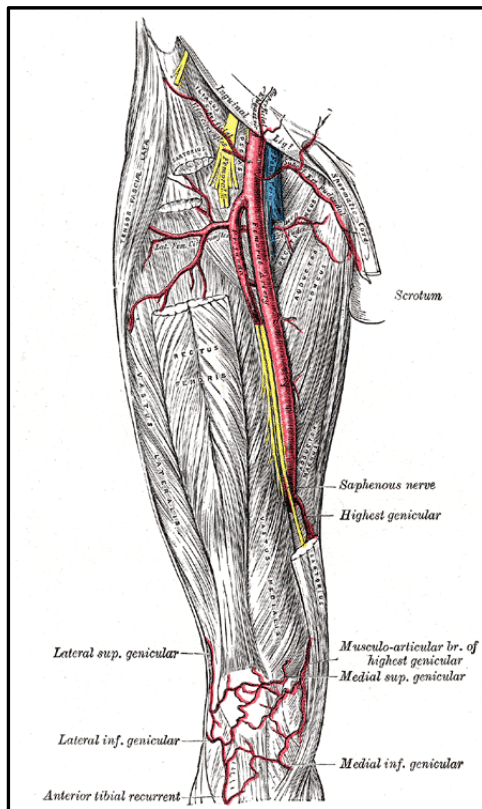
Subjective

- Burning, shooting, sharp or electric shock-like pain
- History of nerve injury or pathology
- Neurological symptoms (numbness, weakness, pins & needles)
- Less responsive to simple analgesics, more responsive to anti-epileptics/anti-depressants
- Severe and irritable pain
- Mechanical pattern associated with loading/compression of neural tissue
- Reports of spontaneous pain

Objective

- Symptom provocation with tests that move/load/compress neural tissue (e.g. neurodynamic tests – SLR)
- Pain with palpation of neural tissues
- Positive neurological findings (altered reflexes/sensation in a dermatomal distribution)
- Hyperalgesia and/or allodynia

Objective Assessment – Palpation



Fingleton, Caitriona & Dempsey, Lucy & Smart, Keith & Doody, Catherine. (2014). Intraexaminer and Interexaminer Reliability of Manual Palpation and Pressure Algometry of the Lower Limb Nerves in Asymptomatic Subjects.

Objective Assessment – Neurodynamics

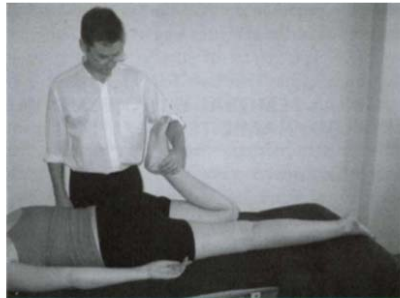


Figure 7.52 Prone knee bend, step 1. Note that no stabilisation of the pelvis is performed.

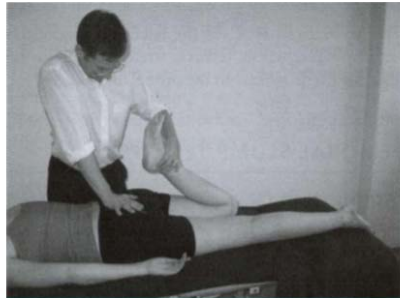
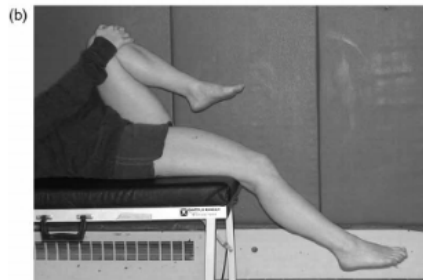
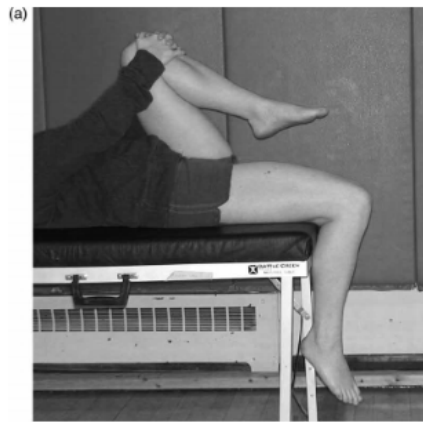


Figure 7.53 Prone knee bend, step 2 with pelvic stabilisation, producing a bias to the neural structures. Step 3 is to repeat the pressure over the pelvis with the lower limb returned to the neutral position.



Figure 7.55 Femoral slump test.

Objective Assessment – Modified Thomas Test



Physical Therapy Treatment Considerations – Muscle 1st Stage

 **the
PRICE
is
Right**

Instead...lets call the **POLICE**



- Protect
- Optimal
- Loading
- Ice
- Compress
- Elevate

Bleakley CM, Glasgow P, MacAuley DC PRICE needs updating, should we call the POLICE? *Br J Sports Med* 2012;**46**:220-221
Maffulli, Nicola et al. "ISMuLT Guidelines for muscle injuries." *Muscles, ligaments and tendons journal* vol. 3,4 241-9. 24 Feb. 2014

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Physical Therapy Treatment Considerations – Muscle 2nd Stage

- Education to promote understanding of activity considerations and/or modifications and expectations
- Movement re-education and/or stretching to promote passive, assisted and active ROM restoration
- Isometric, concentric, eccentric strength progression with consideration placed on non-aggravating activities
- Sensorimotor exercise including balance and stability as indicated



Physical Therapy Treatment Considerations – Muscle 3rd Stage

Focus on Function

- Functional rehabilitation and general athletic re-conditioning
- Sport specific rehabilitation which involves the metabolic system, specific and individualized training protocols, fitness and strength training
- Multi-modal approach to improve sensitive and motor abilities, muscle resistance and strength. Isokinetic and complex “multi task” exercises (including cognitive tasks) are started



Physical Therapy Treatment Considerations – Muscle 4th Stage

Sport/Work specific retraining (as indicated)

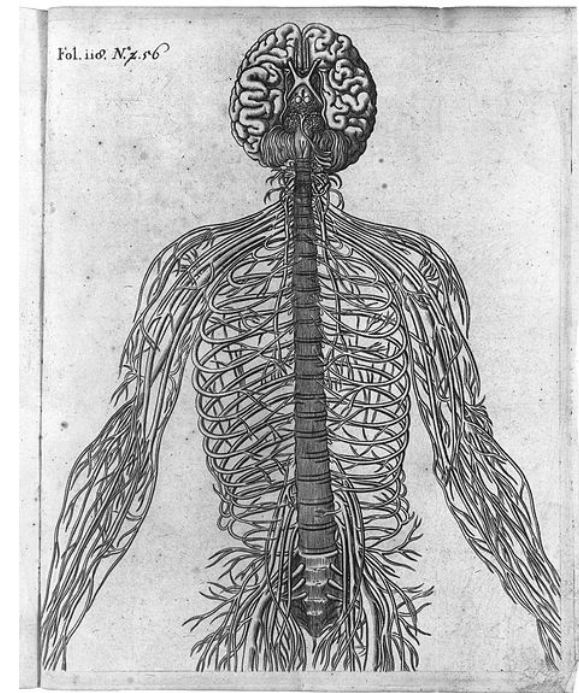
- Athletic reconditioning and specific strength
- Start high intensity training protocols based on strength, athletic reconditioning, and sport specific abilities
- Plyometric, and ballistic exercises are started
- Ability to repeat series of sport specific movements, which had caused the traumatic insult (as applicable)



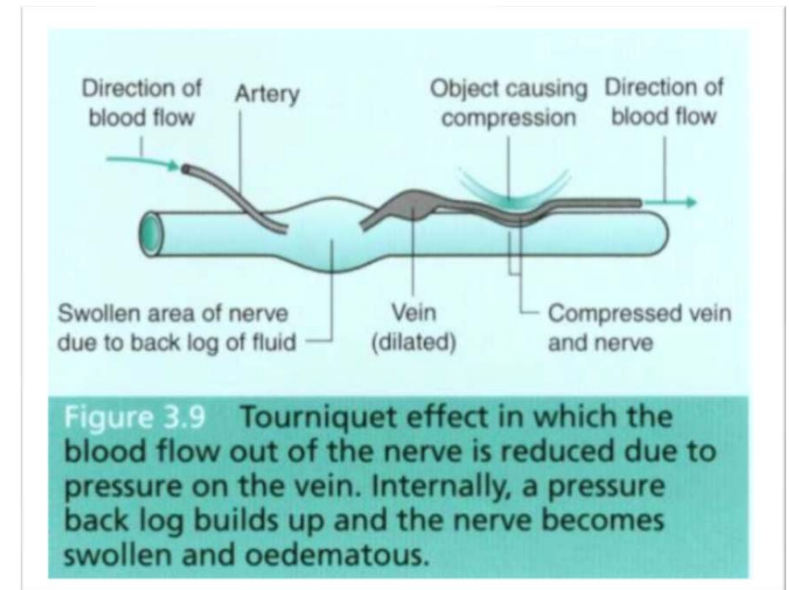
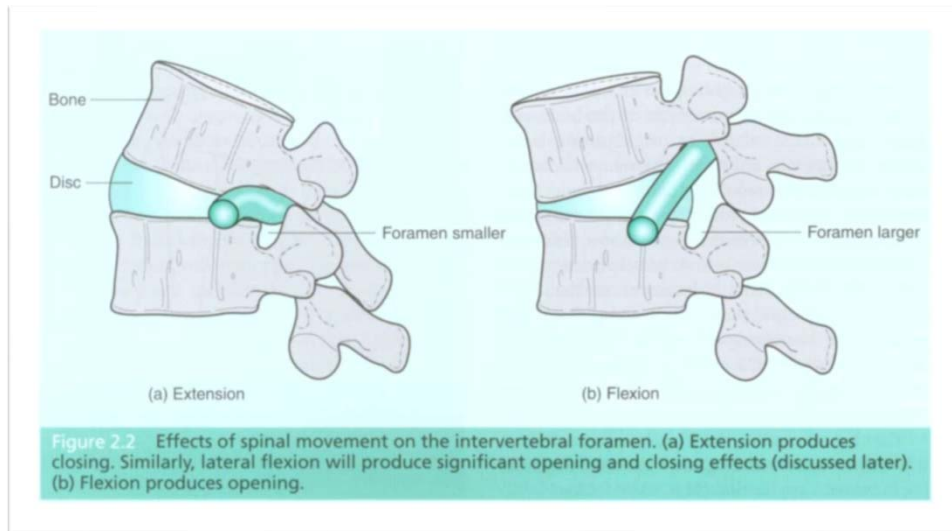
Physical Therapy Treatment Considerations – Nerve

Nerves need...

- Space
 - Clearing the container
- Movement
 - Neurodynamics
- Blood
 - Aerobic exercise



Space – Clearing the Container



Movement – Neurodynamics

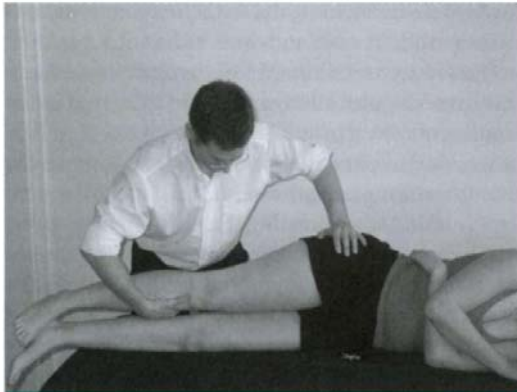


Figure 12.16 Starting position for sliders for the femoral nerve in the thigh.



Figure 12.18 Distal slider for the femoral nerve in the thigh, hip flexion/knee flexion.



Figure 12.17 Proximal slider for the femoral nerve in the thigh, hip extension/knee extension.

Blood - Aerobics



Outline

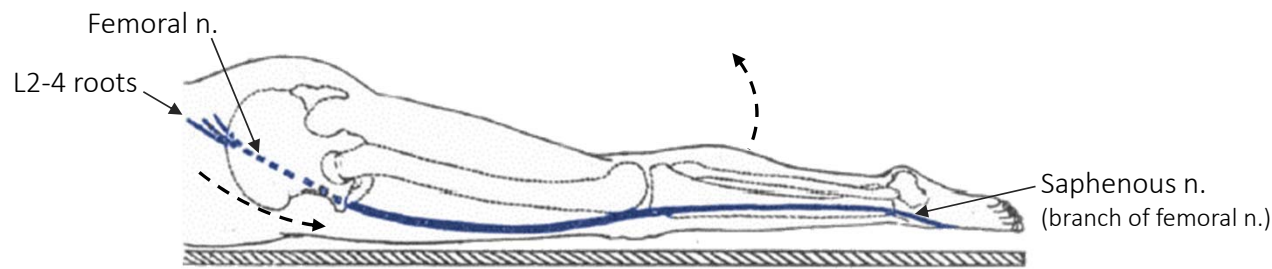
- Anatomy review – lumbar spine, spinal nerves
- High lumbar radiculopathy definition and clinical presentation
- Femoral neuropathy definition and clinical presentation
- Rectus femoris muscle anatomy and response to injury
- Rectus femoris muscle strain clinical presentation
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- Physical therapy diagnostic and treatment approach
- Proposed diagnostic approach – modified femoral nerve stretch test

Neuro exam, low back exam, hip screen indicated for LBP

- Neurologic exam
 - Assess strength, sensation, and reflexes of lower extremities (+/- upper extremities)
- Low back exam
 - Assess gait, ability to heel/toe walk
 - Inspect and palpate low back
 - Assess lumbar range of motion (flexion, extension, sidebending, and rotation)
 - Perform special tests (e.g. femoral nerve stretch test, straight leg raise)
- Hip screen
 - Assess gait, ability to squat up/down
 - Assess hip range of motion (flexion, internal rotation, external rotation)
 - FABER (flexion, ABduction, external rotation) test – assess for ipsilateral hip and sacroiliac joint pathology
 - Ely test

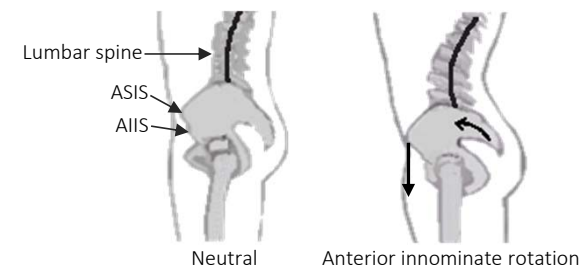
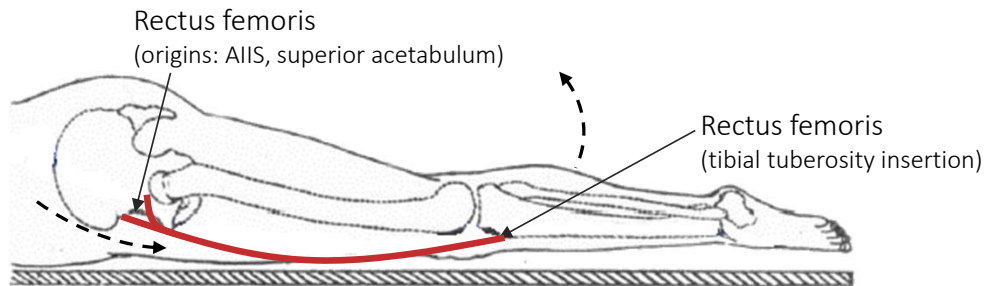
FNST assesses for high lumbar radiculopathy

- Femoral nerve stretch test (FNST)
 - Neural tension sign, assesses for high lumbar radiculopathy
 - Reported positive in 84-95% of patients with known high lumbar IV disc herniation
 - Reported positive in 43-60% of patients with known high lumbar nerve root impingement
- FNST maneuver: patient prone, examiner passively flexes knee of symptomatic side
 - Traction L2-4 nerve roots/femoral nerve inferior and lateral
 - Positive test: pain in anterior thigh or groin, pain in low back
 - Pain caused by stretching compressed/injured L2-4 nerve roots
- Sensitive screening tool but **may be falsely positive with tight or strained rectus femoris**



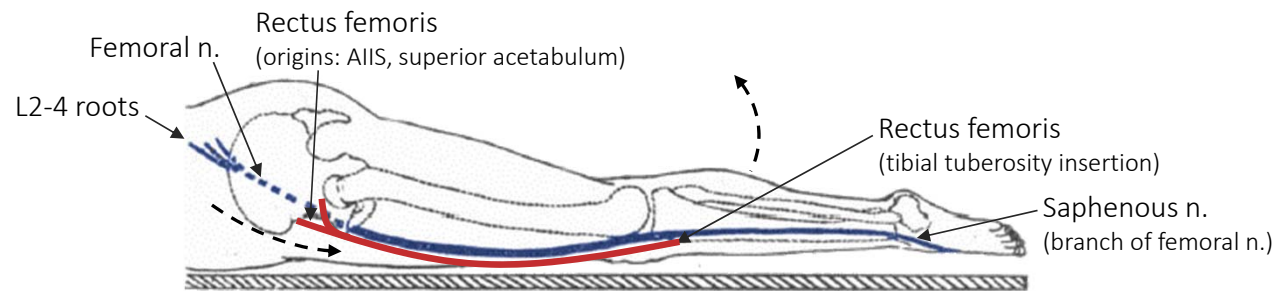
Ely test assesses for rectus femoris tightness

- Ely test: muscle length test, assesses for rectus femoris tightness
- Ely test maneuver: patient prone, examiner passively flexes knee of symptomatic side
 - Stretches rectus femoris by moving its insertion away from its origins
 - Positive test: ipsilateral hip rises off table (innominate rotates anteriorly) with knee flexion
 - Anterior innominate rotation: anterior superior iliac spine (ASIS) moves inferiorly
 - Innominate rotates anteriorly to shorten rectus femoris by moving its origins toward its insertion
- May also cause low back pain
 - Anterior innominate rotation → **lumbar spine extension** → compress posterior/stretch anterior structures
 - Pathology posteriorly (e.g. facet inflammation) or anteriorly (e.g. hip flexor strain/spasm) → **low back pain**
 - **Lumbar extension-induced low back pain may cause false positive FNST**



Ely & FNST: same maneuver, different info, conflicting results

- Maneuver: prone, passive knee flexion
- Information: muscle length (Ely test), neural tension (FNST)
- Findings: both tests may cause low back pain
 - Stretching injured nerve roots (FNST)
 - Lumbar extension-induced low back pain (Ely test)
 - Secondary to innominate rotating anteriorly to keep a tight rectus femoris muscle short



Ely & FNST: same maneuver, different info, conflicting results

- Maneuver: prone, passive knee flexion
- Information: muscle length (Ely test), neural tension (FNST)
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 - Stretching injured nerve roots (FNST)
 - Lumbar extension-induced low back pain (Ely test)
 - Secondary to innominate rotating anteriorly to keep a tight rectus femoris muscle short

Literature has not described a physical exam maneuver to singularly differentiate low back pain secondary to high lumbar radiculopathy from rectus femoris strain, we propose a modified FNST to do so

Modified FNST differentiates radiculopathy & muscle strain

- Maneuver

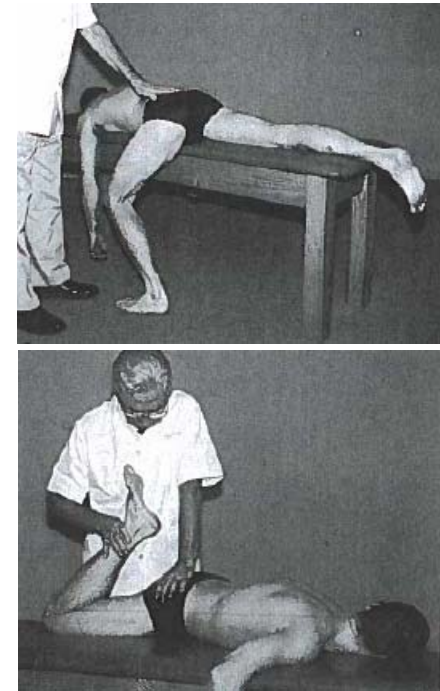
- Patient prone, lower extremity (LE) not being tested flexed at the hip with foot planted on the floor
 - Examiner stabilizes ischial tuberosity of LE being tested
 - Examiner passively flexes knee of LE being tested
- Rotates and stabilizes pelvis posteriorly

- Findings/suggested pathology

- Low back pain → high lumbar radiculopathy
- Stretch in ipsilateral anterior thigh → rectus femoris strain

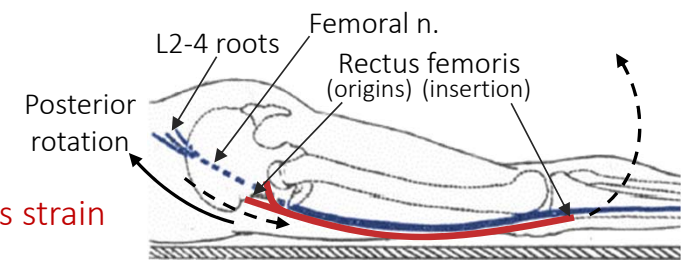
- Few contraindications

- Patient unable to follow directions or communicate symptoms
- Undiagnosed pain with positioning



Modified FNST: stabilizing the pelvis posteriorly is key

- Stabilizing pelvis in posteriorly rotated position
 - Induces/maintains lumbar flexion
 - Increases stretch on L2-4 nerve roots/femoral nerve
 - Prevents lumbar extension
 - Prevents lumbar extension-induced LBP in cases of rectus femoris strain
 - If LBP occurs in this position, unlikely due to rectus femoris strain
 - Puts the origins of rectus femoris on stretch and stabilizes them
 - Allows for optimal rectus femoris length testing
- Knee flexion further stretches L2-4 nerve roots/femoral nerve and rectus femoris
 - Low back pain → stretching of injured L2-4 nerve roots/femoral nerve
 - Posteriorly rotated pelvis prevents lumbar extension-induced LBP secondary to rectus femoris strain
 - Stretch in ipsilateral anterior thigh → lengthening of strained rectus femoris



52 year-old female with LBP and anterior thigh tightness

- Neurologic exam, low back exam, and hip screen indicated
- Neurologic exam
 - 4/5 HF bilaterally due to pain (L2 root level)
 - 5/5 KE (L3 root level), ADF (L4 root level), EHL (L5 root level), APF (S1 root level) bilaterally
 - Sensation to light touch intact bilaterally L2-S2 root levels
 - Patellar reflexes 1/4 bilaterally (L4 root level); Achilles reflexes 2/4 bilaterally (S1 root level)
 - Babinski down-going bilaterally, no clonus bilaterally
- Low back exam
 - Gait normal, heel/toe walk without difficulty
 - No soft tissue or bony abnormalities on back or lower extremities
 - Lumbar flexion, extension, sidebending, and rotation within normal limits
 - Straight leg raise negative bilaterally
 - (+) FNST bilaterally – LBP with passive prone knee flexion

HF: hip flexion
KE: knee extension
ADF: ankle dorsiflexion
APF: ankle plantar flexion
EHL: extensor hallucis longus 48

52 year-old female with LBP and anterior thigh tightness

- Hip screen
 - Gait normal, able to squat up/down
 - (+) FABER test bilaterally
 - Patient unable to localize pain to anterior, lateral, or posterior pelvis
 - (+) Ely test bilaterally
 - LBP and significant rectus femoris tightness with passive prone knee flexion
 - Modified FNST
 - No LBP
 - Significant tightness in anterior thighs, bilaterally → rectus femoris strain most likely
- Treatment of bilateral rectus femoris strains resulted in
 - Decreased anterior thigh tightness and LBP
 - Resolved LBP previously present with passive prone knee flexion
 - Increased knee flexion range of motion present with passive prone knee flexion and modified FNST

Modified FNST is useful in clinical decision-making

- Helps clinically differentiate high lumbar radiculopathy and rectus femoris strain
- Informs further workup
 - Performed osteopathic structural exam for causative/contributing somatic dysfunctions
 - Deferred imaging studies (e.g. CT, MRI), saving time and money
- Informs treatment
 - Provided osteopathic manual therapy (OMT)

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Summary

Osteopathic manual medicine (OMM)

- High lumbar radiculopathy, femoral neuropathy, rectus femoris strain may present similarly (LBP, anterior thigh pain)
- Clinically differentiating the etiologies is important to determine further workup and treatment
- Currently, no physical exam maneuver to differentiate radiculopathy/neuropathy from rectus femoris strain
- Proposed modified FNST helps differentiate neural/muscular etiologies and is useful in clinical decision-making

Physical therapy (PT)

- Diagnostic approach considers pain phenotyping and nociceptive and neuropathic pain
- Objective assessment includes palpation, neurodynamic testing, and special tests
- PT treatment considerations include 4 muscle stages and nerves (space, movement, and blood)

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Low Back Pain

Clinically differentiating high lumbar
radiculopathy and rectus femoris muscle strain

questions?

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